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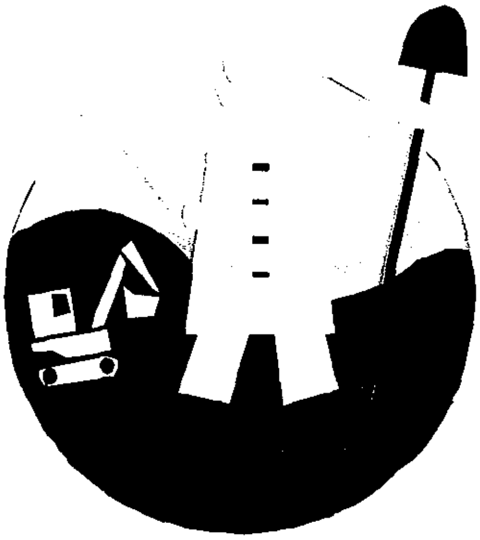
STREAM MAINTENANCE PROGRAM BIOLOGICAL ASSESSMENT



Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118-3686

September 2001

Santa Clara Valley
Water District

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STREAM MAINTENANCE PROGRAM BIOLOGICAL ASSESSMENT-SANTA CLARA VALLEY WATER DISTRICT

LOCATION

Santa Clara County, California

CONTACT PERSON

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INTRODUCTION

The purpose of this Biological Assessment (BA) is to review the Santa Clara Valley Water District's (District or SCVWD) Stream Maintenance Program (SMP) in sufficient detail to determine to what extent the proposed action may affect any of the threatened, endangered, candidate, or special concern species under the Federal Endangered Species Act (ESA) as listed below. The analysis is based on the proposed action presented within three documents: the SMP (SCVWD March 2001), Draft Environmental Impact Report (DEIR) for the SMP (SCVWD March 2001), and the *Final Environmental Impact Report* (FEIR) for the SMP (SCVWD August 2001). This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)).

This list of species under consideration was complied using the following resources: (1) lists of species provided by the U.S. Fish and Wildlife Service (USFWS) on November 28, 2000 (county list, to Doug Padley, District) and November 13, 2000 (by watersheds, to Cindy Roessler, District); (2) Department of Fish and Game's California Natural Diversity Data Base (CNDDB); (3)California Native Plant Society Inventory of Rare or Endangered Vascular Plants of California (5th edition, electronic version, 2000); (4) information provided by District biologists and local experts; and (5) consultation with regulatory agency personnel.

CRITICAL HABITAT

The proposed action addressed within this BA falls within Critical Habitat for bay checkerspot butterfly. Final ruling on Critical Habitat for the bay checkerspot butterfly was established by USFWS on April 30, 2001.

The proposed action also falls within Critical Habitat for steelhead. Final ruling on Critical Habitat for steelhead was established by National Marine Fisheries Service (NMFS) on February 16, 2000. In addition, the Coyote Creek and Guadalupe River Hydrological Units are identified as Essential Fish Habitat for chinook salmon.

Critical habitat for California red-legged frogs (USFWS, March 13, 2001) does not fall within the action area. Critical habitat designations for western snowy plover (USFWS, December 7, 1999) and least Bell's vireo (USFWS, February 2, 1994) do not include any areas in Santa Clara County.

The species considered in this document are:

Threatened, Endangered, Candidate, and Special Concern Species

MAMMALS	Saltmarsh harvest mouse	*Reithrodontomys raviventris*	**E**
BIRDS	Western snowy plover	*Charadrius alexandrinus nivosus*	**T**
	California clapper rail	*Rallus longirostris obsoletus*	**E**
	Least Bell's vireo	*Vireo bellii pusillus*	**E**
REPTILES	San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	**E**
AMPHIBIANS	California red-legged frog	*Rana aurora draytonii*	**T**
	California tiger salamander	*Ambystoma californiense*	**C**
FISH	Steelhead (South/Central California Evolutionary Significant Unit (ESU) and Central California ESU)	*Oncorhynchus mykiss*	**T**
	Chinook salmon	*Oncorhynchus tschawytscha*	**C**
INVERTEBRATES	Bay checkerspot butterfly	*Euphydryas editha bayensis*	**T**
PLANTS	Tiburon paintbrush	*Castilleja affinis* spp. *neglecta*	**E**
	Coyote ceanothus	*Ceanothus ferrisae*	**E**
	Santa Clara Valley dudleya	*Dudleya setchellii*	**E**
	Metcalf Canyon jewelflower	*Streptanthus albidus* spp. *albidus*	**E**
	California seablite	*Suaeda californica*	**E**
	Mount Hamilton thistle	*Cirsium fontinale* var. *campylon*	**FSC**
E= Endangered, T= Threathened, C=Candidate, FSC=Federal Species of Special Concern			

CONSULTATION TO DATE

8/29/01	USFWS (Ms. Cecilia Brown), SCVWD (Ms. Cindy Roessler, Mr. Doug Padley), and consultants meet to discuss USFWS written comments on Draft Biological Assessment.
8/9/01	USFWS sends U.S. Army Corps of Engineers (USACE) written comments on Draft Biological Assessment.
7/26/01	USFWS (Ms. Cecilia Brown and Dan Buford) and SCVWD meet to discuss progress and schedule for review of Draft Biological Assessment.
7/2/01	USACE receives written comments from NMFS on Draft Biological Assessment.
5/6/01	USACE requests consultation with NMFS and USFWS.
5/7/01	USACE (Ms. Molly Martindale), USFWS (Ms. Cecilia Brown), NMFS (Ms. Maura Eagan), SCVWD (Ms. Cindy Roessler, Mr. Ngoc Nguyen, Mr. Doug Padley), and consultants meet to discuss Draft Biological Assessment.
4/18/01	USACE submits Draft Biological Assessment to USFWS and NMFS.
12/26/00	USFWS (Mr. Ken Sanchez) sends list of Biological Opinions issued for Santa Clara County (In response to 11/20/00 request by Mr. Jason Christie).
12/5/00	Ms. Cindy Roessler - Ms. Molly Martindale-U.S. Army Corps of Engineers (Corps) telephone conversation - Corps can cover species outside of jurisdiction. (In response to 12/1/00 email request Corps include listed species outside of Corps jurisdiction).
11/28/00	USFWS (Mr. Ken Sanchez - Ms. Karen Miller) letter to Mr. Doug Padley re Species List for Santa Clara County, in response to Mr. Doug Padley 11/17/00 request.
11/27/00	Mr. Ken Sanchez phone call to Mr. Doug Padley indicating that USFWS will consider indirect effects, especially urban development.
11/13/00	USFWS letter (Mr. Dale Pierce) to Ms. Cindy Roessler in response to Notice of Preparation of DEIR (including list of species).
10/25/00	Ms. Cindy Roessler - Ms. Molly Martindale phone conversation re: Section 7 Consultation under Clean Water Act.
2/10/00	District (Mr. Doug Padley, Mr. Jason Christie, and Ms. Cindy Roessler) meet with NMFS to discuss Habitat Conservation Plan (HCP). District gives NMFS briefing book.
9/29/99	Mr. Doug Padley and Ms. Cindy Roessler meet with Mr. Curt McCasland from USFWS to discuss HCP process and form.
5/25/99	District meets with USFWS to discuss HCP.

5/13/99	Mr. Doug Padley and Ms. Louisa Squires meet with USFWS (Mr. Dan Buford and Mr. Peter Bay) to discuss opportunities and constraints of mitigation at ponds A4 and A8.
2/2/99	Louisa Squires and Mr. Doug Padley meet with Mr. Ken Sanchez and Mr. Dan Buford of the USFWS and Ms. Molly Martindale of the USACE to discuss ponds A4-A8 multi-objective land use plan.
12/24/98	Mr. Jim Ferguson and Ms. Louisa Squires discuss mitigation at pond A8 with Mr. Mike Thabault.
11/17/98	Mr. Doug Padley letter to USFWS outlining scope of HCP, timeline and request for meeting.
11/4/98	Ms. Louisa Squires letter to Mr. Calvin Fong responding to letter from USFWS to Corps about use of Cargill Pond A-8.
10/26/98	Letter from USFWS to Corps objecting to use of Cargill Pond A-8 for wetlands mitigation.
10/3/98	Ms. Louisa Squires discussion with USFWS (Mr. Ken Sanchez) on Pond A8.
9/15/98	Letter from Ms. Louisa Squires to Interagency participants describing field meeting on August 7, 1998 and August 26, 1998.
8/26/98	Interagency Field Meeting with USFWS (Mr. Dan Buford) Pond A8.
8/7/98	Interagency Field Meeting with Corps, U.S. Environmental Protection Agency (USEPA), USFWS (Ms. Janice Gann) Pond A8.
7/28/98	Mr. Doug Padley requests species list from USFWS to cover maintenance projects.
6/8/98	District Urgent Sediment Removal Project Compensatory Wetlands Mitigation and Monitoring Plan: Los Capitancillos Freshwater Migration Site and Pond A8 Tidal Wetlands Mitigation Site.
9/19/97	Meeting with USFWS and CDFG to discuss Section 7 for Maintenance Program DEIR.
6/25/97	Mr. Doug Padley and Ms. Louisa Squires meet with USFWS; USFWS requests Wetland Plan before they will comment.
6/19/97	Submitted Preliminary Compensatory Wetlands Mitigation and Monitoring Plan.
5/14/97	Meeting with USFWS (Mr. Mike Thabault, Mr. Mike Westphal) to discuss USFWS position on ESA issues.
5/6/97	Mr. Doug Padley letter summarizing discussion with USFWS (Mr. Mike Westphal) on maintenance activities which could continue and those activities which needed review.

5/5/97	Mr. Doug Padley letter requesting meeting with Mr. Mike Thabault to discuss maintenance activities and ESA.

CURRENT MANAGEMENT DIRECTION

The District is responsible for water supply and flood protection for Santa Clara County, California. The District is a special purpose governmental agency with a Board composed of five publicly elected and two appointed Directors and authority to levy assessments to fund its activities. The District's jurisdiction and authority is generally independent of the jurisdiction and authority of other local public agencies, including the general purpose governments, the cities and the County of Santa Clara. The District does not have the authority to directly control the land use actions of the county or cities even though they may affect District responsibilities for flood protection and maintenance.

The SMP is designed to provide specific program policies to implement routine stream and canal maintenance projects in order to meet the District's flood protection and water supply objectives in a feasible, cost-effective and environmentally sensitive manner. The main objectives of preparing the SMP are to maintain flood protection and water supply facilities in the streams and canals within the District's jurisdiction to meet their original design, coordinate the various aspects of routine stream maintenance to better achieve this goal, to reduce the environmental impacts of stream maintenance, and to assist in obtaining multi-year permits for these activities.

For many years, the District has been conducting routine maintenance of stream channels and water delivery canals as part of its responsibility for providing water supply and flood protection. These routine activities have, in the past, been subject to a case-by-case determination of potential for environmental impact and appropriate regulatory review. Usually the individual maintenance projects were considered categorically exempt or could be processed by a "Negative Declaration" whereby the District found that all effects were less than significant.

The District is seeking long-term permits from regulatory agencies to cover maintenance over the next ten years. These permits will minimize case-by-case review of maintenance projects and will consider the cumulative effects of permitted stream maintenance activities in a single program.

DESCRIPTION OF THE PROPOSED ACTION

The project applicant is:

Santa Clara Valley Water District
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San Jose, CA 95118-3686
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The District routinely removes sediment from streams and associated facilities to restore their capacity to carry floodwaters, and from canals to restore their water delivery function. Vegetation is routinely removed from in and around streams and canals to meet flood protection and water supply objectives, and to provide access and fire prevention. The District conducts bank protection activities to restore eroded flood protection facilities and to protect property.

Stream maintenance is required to meet the District's flood protection and water supply objectives. Cumulatively, stream maintenance is a substantial activity and expense for the District. Recently, the District adopted the SMP to provide long-term guidance to the District to effectively implement individual routine stream maintenance projects. The SMP specifies a procedure for maintenance design, field operations and mitigation that would constitute Best Management Practices (BMPs). A revised list of BMPs is included in this BA as Attachment A. The SMP includes a regional mitigation program to provide compensation for net wetland and riparian loss and to mitigate cumulative impacts. On August 21, 2001, the District certified the FEIR for the SMP.

The proposed project is implementation of the SMP by the District. The Preferred Alternative adopted by the District is the Modified Pajaro River Basin Alternative, rather than the Multi-Year Program identified in the DEIR. The SMP is designed to provide long-term guidance to the District to implement routine stream and canal maintenance projects in order to meet the District's flood protection and water supply objectives in a feasible, cost-effective, and environmentally sensitive manner. Most routine maintenance addressed by the SMP is undertaken to ensure that flood capacity is maintained in existing streams. Stream maintenance activities occur in three major categories: sediment removal, vegetation management, and bank protection. Additional minor activities, such as fence repair and trash and debris removal, support the functions of the three major routine stream and canal maintenance activities, and are included in the SMP.

Project Location

The District is responsible for water supply and flood protection in Santa Clara County, California. The District manages streams, canals, reservoirs, dams, pipelines, groundwater percolation facilities, and water treatment plants throughout the county to meet its objectives. The routine maintenance activities covered by the SMP are undertaken in streams and canals and adjacent District property and easement (Figure 1). Only those streams within the District's jurisdiction are included in the program. The District's jurisdiction on a stream begins at the point where 320 acres (½ square mile) of watershed drain to the stream and continues downstream to San Francisco Bay or the limits of the Pajaro River in Santa Clara County. The area within the District's jurisdiction consists of 191 streams for approximately 828 miles and 10 canals for approximately 41 miles (Figure 1. Streams and Canals in District Jurisdiction).

Although the District has jurisdiction throughout Santa Clara County, the SMP excludes sediment removal and vegetation management on stream reaches above the 1,000-foot contour level. In addition, any sediment removal, wetland vegetation control, or removal of in-channel trees in Llagas Creek downstream of Highway 152 to the confluence with the Pajaro River and in the Pajaro River within Santa Clara County, are excluded from the SMP. Hardscape bank protection projects which reduce or eliminate biotic potential and would occur in high quality fisheries habitat or existing high quality riparian habitat are also excluded from the SMP. Projected work areas for the SMP include any stream below dams and a selected few locations above reservoirs. For this program, the baseline conditions for the analysis are those that currently exist on streams in the projected work areas. Generally, these areas have been subjected to years of prior stream maintenance activity. Any proposed stream maintenance activities outside of the area covered by this analysis (i.e., all areas above the 1,000-foot contour level) or other activities excluded from SMP (i.e, sediment removal or in-channel vegetation removal in lower Llagas Creek and the Pajaro River) would need to be evaluated under a separate environmental review and permitting process.

As a program, the SMP does not provide a detailed level of information for each future work site. The geomorphology and biology sections of the DEIR include descriptions of the various types of geomorphic conditions and habitats present within the project location, and pages IV-B-17 through IV-B-27 of the DEIR describe categories of fish habitat present in the project area. The fisheries habitat categories are also mapped in Figure 4 of the BA.

Work Projections and Planning Horizon

The SMP is intended to establish an indefinite, ongoing District program. The SMP and Program EIR use a 20-year planning time-frame to evaluate cumulative impact. Regulatory permits are expected to last for a period of 10 years, after which time the District would apply for renewal.

The projections for future work under the SMP is based on analysis of historical data going back to 1977. All forms of maintenance show a consistent pattern; however projections of future stream maintenance activities for the SMP and Program EIR cannot represent the exact extent of work that will occur. Actual stream maintenance activities can vary widely from year-to-year. There may be some future routine maintenance activities that are consistent with the descriptions of work and impacts overall, but which were not specifically included in the District's projection of work areas. Maintenance at such sites is still included in the SMP as long as it does not result in significant environmental effects substantially different than those evaluated for the SMP as a whole.

Activities not included in the SMP include emergency repairs, which involve a clear and imminent danger that demands immediate action to prevent or mitigate loss of or damage to life, health, property, or essential public service. Large construction projects and Capital Improvement Projects (CIPs) are not considered routine stream maintenance and are not addressed through the SMP. In addition, other District maintenance activities that are not routine maintenance, not located within or next to streams or canals, or alter the design flood conveyance or water supply capacity of a stream or canal are not included. Maintenance of groundwater percolation ponds; instream summer dams; reservoirs and dams; pipelines outside of stream corridors; and installation/modification of new fish ladders are not included. Work conducted on private property by owners or by other agencies is not included. The following maintenance activities are excluded from the SMP because they are located where there is insufficient environmental information, there is high environmental sensitivity, or the magnitude of the activity is greater than is reasonably considered routine maintenance: sediment removal and vegetation management on stream reaches above the 1,000-foot elevation contour which is above the reservoirs; hardscape bank protection projects which reduce or eliminate biotic potential and would occur in high quality fisheries habitat or existing high quality riparian habitat; any sediment removal, wetland vegetation control, or removal of in-channel trees in Llagas Creek downstream of Highway 152 to the confluence with the Pajaro River and the Pajaro River within Santa Clara County. This section of Llagas Creek has not been regularly maintained as provided for in the original flood protection project design (co-sponsored by the Natural Resources Conservation Service under Public Law 566) over the past few years because of sighting of a nesting pair of least Bell's vireo and for other reasons. In the meantime, young trees have developed substantial growth in this section of the creek and their removal has the potential for environmental effects not within the scope of vegetation management reviewed under the SMP. Maintenance work in this section of Llagas and the Pajaro River is not considered routine until the status of least Bell's vireo at this location is determined and a plan for future maintenance developed. At that time, future routine maintenance will be evaluated under a new or revised California Environmental Quality Act (CEQA) evaluation. Control of giant reed on the Pajaro River and Llagas Creek is included in the SMP.

Sediment Removal

Sediment removal activities are conducted to maintain the capacity of District flood protection facilities. As such, sediment removal is conducted most frequently in engineered or modified channels. Because many stream systems in Santa Clara County are highly constrained by urban development, natural hydraulic function of streams have been altered. Sediment tends to accumulate repeatedly in areas where the stream gradient flattens out in the valley floor or other long, flat reaches, which require routine removal of sediment to maintain flood capacity. Sediment is removed from natural creeks only on an occasional basis to provide proper functioning of outfalls, culverts, bridge crossings, and stream gauging stations. The District estimates that an average of 80,000 cubic yards of sediment on about 16 miles of channel would be removed annually. This average includes both concrete-lined and earth-lined channels. Actual annual sediment removal would vary depending, in part, on rainfall conditions of the past winter season. Sediment removal can occur anywhere between the levee slopes. Cumulatively, sediment removal is projected for approximately 60 miles of streams. Sediment removal from canals is estimated to be less than 1,000 cubic yards per year.

The geomorphology section in the DEIR (pp. IV-A-13, 14) describes the general factors contributing to stream deposited sediment. As described on page VI-10 of the DEIR, when the District reviews new projects proposed within 50 feet of a creek under District Ordinance 83-2, it comments on design aspects which might affect sediment loading among other factors. The District, as a responsible agency under CEQA, comments on the same topics when it reviews environmental documents prepared for such projects and General Plan updates.

Sediment removal involves mechanically removing sediment that has been deposited within a stream channel. Typically, sediment is removed using excavators, draglines, loaders, and 10- or 20-cubic yard dump trucks. The method used to remove sediment is dependent on channel configuration and geometry, equipment reach and rate of removal, channel type (tidal or non-tidal, concrete or earth bottom), moisture content of the silt, ramp location and access road width. Concrete-lined channels may be cleaned by pushing sediment into a pile with a bulldozer and/or removing the sediment using an excavator. Sediment is then loaded into trucks that are located either in the channel bottom or the top of the bank and disposed at an approved site. Saturated sediment may be temporarily placed adjacent to the work site to dry out before being removed to a suitable disposal site. To remove sediment from wide channels that have bottoms that will not support equipment, such as tidal sloughs, a dragline or excavator is positioned on the top of the bank instead of the channel bottom.

Most often, sediment removal projects are implemented in the dry season (between June 15 and October 15). If water must be by-passed around the site during work, water pumps and piping, and cofferdams may be used. In some cases, a bypass channel or detention basin may be used to isolate a site. Temporary access roads and ramps may need to be constructed during sediment removal.

Recently, the District developed guidelines for conducting sediment removal on unmodified streams (included as Attachment B in the BA).

Vegetation Management

Management of vegetation in and adjacent to creeks and canals is necessary to maintain the ability of channels to function as flood protection facilities and canals to transport water. Dense vegetation can adversely affect the ability of the channel to contain the flow of flood waters for which it was designed. Therefore, most flood protection facilities require some type of periodic vegetation control. Depending on the original design and the characteristics of the channel, the frequency of vegetation management varies from annually to every few years.

Vegetation management for environmental purposes includes control of invasive, non-native plants. The District also uses vegetation management to control weeds at revegetation sites to increase the number of native trees and shrubs which survive and to more quickly establish a self-sustaining plant community that provides wildlife habitat.

The District manages vegetation for other purposes including the protection of levees, and concrete linings from plant roots; meeting local fire codes requiring control of combustible weeds and grasses; providing visual clearance to inspect the condition of a facility; and providing access along maintenance roads.

Over the past 30 years, the District has continually revised vegetation management approaches on District facilities. The three basic methods of vegetation management are: hand removal (chain saws, weed-eaters, etc.); mechanical (mowing and discing); and chemical control through the use of herbicides. A method or combination of methods is chosen for each site depending on the maintenance requirements of the facility. Efficiency, economics, and the protection of public health and environmental resources are all considered in the selection of methods.

Recently the District developed guidelines for conducting vegetation management on unmodified streams (see Attachment B of this BA).

In-channel Vegetation Management

In-channel vegetation management occurs on the channel bottom of the creek or canal where seasonal aquatic conditions can create conditions suitable for wetland or riparian vegetation. Portions of the channel above the bottom, such as benches, or channel banks or slopes, which do not support seasonal aquatic conditions are not included as part of in-channel vegetation management (See "Upland Vegetation Management" below). The two types of in-channel vegetation management are herbicide application and hand removal of vegetation. Herbicide use is described in more detail in the "Herbicides Used" section below.

Weeds, shrubs, and trees are removed by the hand removal method where it is not possible to access the area with spray or mowing equipment. Trees with trunk diameters up to 6" diameter at breast height (dbh) are removed by the hand removal technique, although the actual number of trees removed by this method is very limited. In some cases, the vegetation is sprayed with herbicides, and then approximately 6 months later, the dead material is removed by hand. Follow-up hand removal of dead vegetation is only necessary when herbicide spraying is new to an area and there is a large volume of vegetation created in the first year or two. In subsequent years, the amount of vegetative regrowth is reduced and follow-up hand removal is necessary much less frequently.

Upland Vegetation Management

Upland vegetation management occurs on upland areas associated with creeks and canals including all land above the channel bottom such as the levee or bank top and slopes, benches, and maintenance roads inside the levee, and adjacent land outside the levee. These upland areas are not seasonally inundated by water so as to create conditions for wetlands, and are vegetated with upland plants, primarily annual grasses or shrubs. Five types of vegetation management methods in upland areas are discing, mowing, herbicide application, hand removal, and removal of over-hanging growth.

Upland discing occurs on upland parcels outside of the streambanks and is conducted to create firebreaks. Upland mowing consists of operating a flail mower to eliminate or reduce grasses that would cause a fire hazard during the summer. Mowing can occur from one to three time annually at each location, usually between May and October. Mowing is conducted on the inside slope of some levees or streambanks.

Upland herbicide spraying is used on levees, unpaved maintenance roads, and along some property lines. On levees, herbicides are used primarily to keep woody vegetation and broadleaf weeds from becoming established where they will interfere with flood flow capacity, damage the levee, or hinder their inspection. Weeds and grasses are sprayed on maintenance roads to clearly define and keep open the access route. Herbicide spraying along property lines assists in establishing a firebreak. Pre- and post-emergent herbicides are sprayed from a truck-mounted rig or by a controlled drop applicator.

Hand removal of vegetation is conducted in upland areas where mowers cannot access, and herbicides are either not practical due to steep terrain or not allowed. Hand removal of vegetation is generally used in upland areas along property lines to establish fire breaks. Removal of overhanging growth consists of pruning tree branches that impede access roads or hang over fence lines.

Extent of Vegetation Management Work

The frequency of vegetation management activities varies from semiannually to once every several years, depending on the method used. Generally, vegetation management in channels is conducted once a year. Channel herbicide work is conducted throughout the summer dry season whereas channel hand removal is conducted near the end of the growing season. Seasons of work for vegetation management are generally undertaken in the following time periods. Some adjustment to these time periods can occur on some project sites where provisions regarding nesting birds and anadromous fish are followed as provided in BMPs 3.2

and 3.10. Herbicide treatment is undertaken in the channel from July 1 through October 15. Upland herbicide work is undertaken from October 15 through June 30. Removal of woody saplings by hand is undertaken July 1 through March 1. Hand removal of herbaceous wetland vegetation is undertaken in November and December.

On average, vegetation management work is annually performed on roughly 4,000 acres. Within this larger work area, the targeted treatment area consists of approximately 2,000 acres. These totals include the following approximate levels of activity:

- 866 acres on which vegetation management work is conducted in 212 miles of stream channels with 120 acres of the total actually receiving treatment (585 work acres or 75 acres of treated area on 166 miles in the Santa Clara Basin, and 280 acres or 45 acres of treated area and 46 miles in the Pajaro River Basin).
- 23 acres on which vegetation management work is conducted on 27 miles of canals with 6 acres of the total actually receiving treatment.
- 3,012 acres of uplands on which vegetation management work is performed, with 1,894 acres actually receiving treatment. Upland vegetation management is outside of the area of inundation, and generally has a buffer of grass or vegetation on the slopes between the right-of-way and the stream.

Vegetation management activities are consistent from year-to-year. Slight variations in flood protection activities occur due to weather patterns. For example, historically, increases in some work activities have occurred during drought years, with decreases in some activities occurring during flood years. This is primarily due to the scouring effects of flood flows cleaning out areas of vegetation. Right-of-way activities remain constant regardless of these weather patterns. Revegetation maintenance reduces 3 to 5 years after initial installation of a revegetation site.

Herbicides Used

Herbicides often are more effective at controlling vegetation than mechanical or hand removal methods. This is because of the ability of the herbicide chemicals to spread into and damage the roots of the target plants, thus preventing re-sprouting. When treated with mechanical or hand methods, some woody plants, such as willow, will re-sprout with multiple stems. The multiple sprouts result in a greater flood protection problem and require annual control. With herbicides, annual retreatment is often necessary, but the treatment area is greatly reduced, as only a small percentage of regrowth will occur. As a result, the SMP will continue to use herbicides as the primary method by which vegetation is controlled in the Santa Clara Basin. Because of concerns regarding the gradual environmental change to wetlands, herbicide use in the Pajaro River Basin will be limited to the following situations: upland areas including channel banks, levee slopes, maintenance roads and fire breaks above the channel bottom; and upland and channel bottom areas for the control of invasive exotic plants.

Herbicides are not broadcast sprayed across the channel, but are selectively sprayed at the herbaceous or woody plants targeted for removal by the design parameters of each particular stream reach. In streambeds where the removal of woody plants is required, only saplings no greater then 2" dbh are treated with herbicides in the target area. In upland areas, herbicides are sprayed on maintenance roads to provide clear access area and on levee slopes to eliminate broadleaf weeds.

The District staff routinely reviews new and changed herbicide formulations and changed label limitations. New products are selected and old products are discontinued due to the changing availability and suitability of the products for District use. The District uses criteria for product selection that minimizes work and public health risk and avoids environmental impact. The District will not use herbicides that are:

1. designated as a restricted material by the US Environmental Protection Agency (EPA) based on toxicity or environmental effect,
2. on California Department of Pesticide Regulation (CDPR) "list A" for demonstrated ground water contamination.

A variety of sources of information are available to instruct the District in its choice of herbicides. A literature review was conducted for the SMP (SMP Appendix H). The literature review presents use, health and environmental information about the principal herbicide products that the District currently uses, along with general product information and site-specific conditions to determine whether and how a product should be used.

The District uses herbicides according to the label directions and for uses approved by the EPA and CDPR. Currently, the primary herbicide which the District uses to control in-channel vegetation is glyphosate, a nonselective broad spectrum herbicide. Glyphosate products include Monsanto's Roundup Pro® and Monsanto's Aquamaster® (an aquatic formulation formerly marketed as Rodeo®). Aquamaster® is approved for use on and near open water, whereas Roundup Pro®is not approved for application directly in water or to areas where surface water is present. Roundup Pro® contains glyphosate, a surfactant and water. Surfactants aid the ability of an herbicide to penetrate the surface of vegetation. Aquamaster® and Rodeo® contain glyphosate and water without a surfactant. The District generally adds the surfactants R-11® or Target Pro-Spreader when using Aquamaster® or Rodeo®.

Pre-emergent herbicides control vegetation on levees and access roads by preventing the germination of weed seeds. The District uses a range of pre-emergent herbicides, including pendimethalin and chlorsulfuron.

The CDPR has recently proposed new restrictions on the use of certain pre-emergent herbicides, including several which the District uses (sulfometuron-methyl, chlorsulfuron, oryzalin and isoxaben). These restrictions are intended to minimize potential ground and surface water contamination. The District is currently reviewing the recent proposal and will determine whether its Herbicide Program will need to be adjusted.

The District also uses herbicides in accordance with guidelines established in the EPA Bulletin, *Protecting Endangered Species, Interim Measures for Use of Pesticides in Santa Clara County* (USEPA 2000). The Bulletin provides guidelines for the use of pesticides in habitats potentially occupied by federally listed species. The Bulletin provides a list of pesticide use limitations that are designed to avoid impacts to the listed species covered by the Bulletin. Although compliance with these use limitations is not required by law, the limitations are recommended to minimize impacts.

The Bulletin covers the herbicides potentially used under the SMP (rodenticides are discussed below under "Minor Stream Maintenance Activities"). The use limitations applicable to a specific pesticide are based upon:

1. The class of the pesticide, e.g., herbicide, insecticide, fungicide, or rodenticide (grain baits or fumigants)
2. The active ingredient of the pesticide
3. The activity category, which broadly defines the mode of action and use patterns of the pesticide
4. The listed species potentially occurring at the use site, which are classified into hazard classes based upon characteristics such as life forms and habitat requirements

These four components determine the use limitations that should be implemented when using a particular pesticide to minimize adverse effects to listed species. The hazard classes relevant to the SMP are shown in the following list. Because the Bulletin is designed to minimize impacts to federally listed species, it does not include other special-status species. Nonetheless, characteristics of the other special-status species included in this analysis that may be adversely affected by herbicides can be used to determine the appropriate hazard class, and thus use limitations, for those species. The federally listed species included in the SMP that are also in the Bulletin, if any, are provided first, followed by other special-status species that may be affected by herbicides.

1. AQ (Aquatic Animals): Chinook salmon, steelhead, California clapper rail, California red-legged frog, foothill yellow-legged frog, California tiger salamander, western pond turtle, California black rail
2. PD (Dicot Plants): Tiburon paintbrush, Coyote ceanothus, Santa Clara Valley dudleya, Metcalf Canyon jewelflower, California sea-blite, pappose spikeweed, Mount Hamilton thistle, Santa Clara red ribbons, Hospital Canyon larkspur, San Francisco wallflower, smooth lessingia, most beautiful jewelflower
3. PM (Monocot and Gymnosperm Plants): Clustered lady's slipper, fragrant fritillary

Table 1 provides the use limitation codes from the Bulletin that apply to the herbicides potentially used by the District. (All tables are included at the end of the document.)

As prescribed by BMP 3.20, the District will implement measures to avoid or minimize impacts from herbicides to non-target species. Herbicides used for vegetation management will be used in a manner to minimize negative environmental effects, including application by certified workers in accordance with to the manufacturer's specifications (e.g., Aquamaster®) when applied within the banks of the channels in concentrations that have no observed adverse effect on special-status species (BMPs 3.20 and 4.7). The Bulletin recommends that the following Use Limitations Codes (ULC) be implemented where non-target species may be affected.

ULC 11. Do not use in currently occupied habitat except: (1) as specified in Habitat Descriptors, (2) in organized habitat recovery programs, or (3) for selective control of invasive exotic plants.

ULC 15. Provide 20-foot minimum strip of vegetation on which pesticides will not be applied along rivers, creeks, streams, wetlands or on the downhill side of fields where run-off could occur. Prepare land around fields to contain run-off by proper leveling, etc. Contain as much water "on-site" as possible. Mix pesticides in areas not prone to run-off such as concrete mixing/loading pads, disked soil in flat terrain or graveled mix pads, or use a suitable method to contain spills and/or rinsate. Properly empty and triple-rinse pesticide containers at time of use.

ULC 16. Time applications to allow sprays to dry prior to rain or sprinkler irrigations.

ULC 17. Apply sprayable or dust formulations when air is calm or moving away from occupied habitat.

ULC 19. Do not apply within 30 yards upslope of habitat unless a suitable method is used to contain or divert runoff waters.

Vegetation Management in the Pajaro River Basin

The SMP includes the limited use of herbicides as part of the Vegetation Management Program in the Pajaro River Basin. Herbicides are currently used as part of the Vegetation Management Program in the Santa Clara Basin, but their use was discontinued in the Pajaro River Basin (South County) at the direction of the District Board in 1974 because of complaints regarding drifting of herbicides into agricultural fields.

Since that time, the District has revised its Herbicide Program to address environmental, health risk and public safety concerns, but at the same time recognize that herbicides are a cost effective means for maintaining flood protection and water supply facilities. Many of the improvements made to the District's Herbicide Program are described below:

- In 1980, the District discontinued the use of the herbicide 2,4-D.
- In 1986, the District switched to using herbicides in the sulfonylurea family which are applied at rates of ounces per acre rather than previous herbicides which were applied at rates of pounds per acre. This step not only reduced the overall amount of herbicides being applied throughout the County but also relied on using herbicides with a lower toxicity.
- In 1988, the District went beyond State requirements and required all District employees who handle pesticides to be certified as a Qualified Applicators by the CDPR. As Qualified Applicators, these employees are trained on pesticide laws and regulations, safety, and application methods, and are required to receive annual training to keep updated in this field.
- Likewise, even before State requirements, the District required that a District Pest Control Advisor (PCA) prepare a pesticide use recommendation for any use of herbicide on District facilities. For the District's purposes, PCAs are required to have a relevant Bachelors degree, be trained in integrated pest management and groundwater, and continue to receive 40 hours of relevant training every two years.

- At the District, the PCA is required to conduct a field survey to assess the site conditions, types of weeds and non-target plants, surrounding land uses, and potential wildlife use prior to writing a pesticide use recommendation. This information is used to make a recommendation with detailed instructions to the applicator regarding the type of herbicide, rate, equipment, treatment area identified on a map, target vegetation, vegetation to protect, and any special instructions relevant to the site and treatment.

- Certain types of herbicides were found as contaminants in groundwater in California's Central Valley. Although no restrictions were placed by the state on their use in Santa Clara County or on soil types found in Santa Clara County, the District voluntarily discontinued the use of certain pre-emergent herbicides on District facilities in 1993 to avoid any potential problems with groundwater. This practice continues today. PCA's receive groundwater training every two years from the CDPR and receive routine updates in changes to the regulations. Though none of the regulations currently apply to this county, the District discontinues use of products that are known groundwater contaminants in other areas of the state.

- In 1994, the District voluntarily eliminated the use of residual pre-emergent herbicides on our groundwater recharge facilities. Today, only herbicides that are registered for use in aquatic areas are used at these locations.

- In 1996, the District retrofitted its spray trucks to include the Patchen WeedSeeker. This device utilizes a light sensor attached to the front of the spray equipment that detects the presence of chlorophyll (and therefore living plants) and controls individual spray heads. Instead of spraying the entire width of a facility as the spray truck passes over it, individual spray heads are turned on only as they pass over vegetated areas. This eliminates the treatment of bare ground and reduces the amount of herbicide applied by 20 to 90 percent. This equipment is primarily limited to use on flat areas where all vegetation needs to be controlled, such as maintenance roads.

Under the SMP, herbicide use in the Pajaro River Basin will be limited to the following situations: upland areas including channel banks, levee slopes, maintenance roads and fire breaks above the channel bottom; and upland and channel bottom areas for the control of non-native invasive plants.

Historically, routine vegetation management has been limited at the following locations in the Pajaro River Basin: Llagas Creek from Chesbro Reservoir to Machado Creek, Llagas Creek from Hayes Creek to Church Avenue, Jones Creek and Uvas-Carnadero Creek. Work in these areas under the SMP will continue to be performed as described in the maintenance guidelines for each facility and as described in the engineering guidelines for improved facilities. Vegetation management in these areas will continue to be limited to the control of nonnative invasive species and the hand removal of woody saplings less than 2" dbh which occur no closer than 20 feet apart.

Bank Protection

Bank protection involves any action by the District to repair stream banks that are eroding as well as to prevent bank erosion. The District proposes to implement stream bank repair when the problem: (1) causes or could cause significant damage to a property or adjacent property; (2) is a public safety concern; (3) negatively affects transportation or recreational use; (4) negatively affects water quality; or (5) negatively affects riparian habitat. Repairs would take several forms ranging from the installation of hard structures (i.e., rock blankets, concrete, sack concrete, gabions) to the use of soft structures (i.e., willow brush mattresses, log crib walls, pole plantings), or a combination of hard and soft structures. Bank protection also includes preventive maintenance to ensure that banks do not erode in the future. Such erosion protection can reduce sedimentation and improve water quality.

Stream bank erosion is a natural process, which mostly happens during major storm events. Erosion can occur because of hydraulic forces and geotechnical instabilities, and can be accelerated by human intervention and land uses. Accelerated erosion is typically a result of particular land uses that affect the stream corridor, including grazing, agriculture, and road and utility construction. Erosion of banks can result in increased sediment deposition, which can lead to decreased flood flow capacities and potential flood hazards. Erosion on banks may also cause vegetation and soil loss, damage to private or public property, transportation and utility impacts, safety hazards, and turbidity injurious to fish and aquatic life. Levee erosion may lead to failure of the structure and flooding. Regional factors causing bank erosion are described in the DEIR (pp. IV-A-10 through IV-A-13, and IV-A-20 through IV-A-21).

Bank protection work may either occur as repair of an existing bank protection project which is failing, or as new work along a bank which is eroding. Repair of former work provides the opportunity to incorporate new designs with better engineering and environmental benefits. Bank protection is considered routine and is included in the SMP because it is a regular and frequent function the District must perform. The new bank work is also considered routine maintenance because it often is restoring the flood protection function of a modified channel. Typically the District conducts some form of erosion and bank repair at 30 to 50 different sites each year. Approximately 70% of bank protection work will be done on unmodified channels and 30% will be done on modified channels for the reasons cited above or to restore the modified channel design elements.

Bank protection measures that create extensive inflexible, impervious channel banks with essentially no revegetation are termed "hard" and the product is called "hardscape." Measures that retain natural earth banks and have a higher capacity to support vegetation are termed "soft" and the product is termed "softscape." Although the intensity of impact varies within a category and depends upon the site conditions, hard methods generally limit biotic potential of a site and soft methods tend to retain biotic potential. The former have the greatest potential for adverse effects, and the latter generally are less likely to have adverse effects and even have the potential to improve site quality. Recognizing the potential effects due to exclusive use of hardscape materials, the District is committed to installing no more than 50% of future bank protection using hardscape methods. Recent designs of bank protection measures that employ hardscape materials have evolved with the emphasis of limiting such use to the extent practicable. Also, revegetating the stabilized slopes with native vegetation has become the norm wherever site conditions allow. This is especially true in unmodified channels that still retain riparian value. The methods are defined and illustrated in the revised Appendix E of the SMP (included as Attachment C of the BA). These measures are updated when new, feasible methods or types of equipment become available.

Based on 13 years of historical records, the District estimates that an average of roughly one linear mile of stream banks may be repaired annually. Many erosion sites are small (less than 500 feet) and are not easily predicted. The quantity and location of bank protection activities varies greatly from year-to-year, based on watershed conditions (heavy rains often lead to more work in the following year), degree of safety hazard, work load, budget, and quantity of other priority work to be done in a given year. The description of historical bank protection in the SMP shows a greater concentration of bank protection occurs in cities and semi-rural foothills of the Santa Clara Valley. Actual future bank protection work would be done anywhere it is needed within District jurisdiction.

Many areas receiving bank protection are devoid of native riparian vegetation as a consequence of erosion. The District's design criteria may determine that soft erosion control methods are not adequate at a particular site. Therefore, some bank protection would utilize hardscape methods, and riparian vegetation may be precluded from re-establishing. The general design criteria and cross-section for each of the bank protection methods used by the District are included in Attachment C. In addition to those criteria, design of a particular bank protection project includes evaluation of other site specific characteristics such as bank slope, shear stress, location such as the inside or outside of a curve, soil type, flow velocity, characteristics of the channel adjacent to the site and the available right-of-way. The site is evaluated for the repair method consistent with the characteristics of the site. Revegetation potential is also evaluated for each bank protection project. This potential is not only dependent upon the method of bank protection used, but also the physical properties of the stream where the repair is taking place.

Equipment used for bank protection may include excavators, dozers, cranes, loaders, and 10- and 20-cubic yard dump trucks, concrete trucks, and pumps and water trucks. If water must be bypassed around the site during repair work, water pumps and piping, and cofferdams of earth, gravel, sandbags, hay bales, rubber or other suitable material may be used. In some cases, a bypass channel or detention basin is appropriate to isolate a site. Most often, bank protection projects are implemented in the dry season. The average duration of bank protection work is 10 working days. Bank protection maintenance activities generally occur between June 15 and October 15, but the work can begin sooner or later than these times depending upon the conditions in the field. Temporary access roads and ramps may need to be constructed during bank protection work.

An important feature of the SMP is a programmatic approach to impact assessment and mitigation at bank protection sites that takes into account fisheries and riparian resources values. The types of bank protection measures used are described in Attachment C. The bank protection work would include both hardscape and softscape designs with mitigation provided at a 1:1 ratio by area of streambanks for rock hybrid designs with plantings and a 3:1 ratio by area of streambank for impervious hardscape and other rock designs without plantings. On an average annual basis, no more than one half mile of impervious hardscape designs will be installed.

Minor Stream Maintenance Activities

Routine stream maintenance includes the following minor activities that could affect special-status species: trash removal at trash racks and more generalized locations; repair and installation of fences and gates; grading and other repairs to restore the original contour of access roads and levees; grading small areas without vegetation above streambanks to improve drainage and reduce erosion; repair of structures with in-kind materials within the same footprint (such as replacement of concrete linings, culverts, pipes, valves, or similar structures), using NMFS stream crossing guidelines; cleaning and minor sediment removal at stream gages, outfalls, culverts, flap gates, tide gates, inlets, grade control structures, fish ladders, and fish screens; graffiti removal; tree pruning along maintenance roads and fence lines to provide access and to remove hazards; irrigation, weeding, replanting, and other types of ongoing maintenance at mitigation sites; removal of obstructions to flow in the immediate vicinity (not to exceed 100 feet) of bridges, streamflow measuring stations, box culverts, storm drain outfalls, and drop structures to maintain functions of such structures; removal of trees or branches that are in imminent danger of falling, fallen trees, and associated debris to maintain channel design capacity; and ground squirrel and rodent control with traps, smoke bombs, and pesticides.

Rodent control is directed primarily at ground squirrels and occasionally gophers whose burrows threaten the integrity of levees, dams, or canal banks intended to retain water. The District specifies the area to be treated and the contractor selects the methods from those permissible by law and the County Agricultural Commissioner. Currently, the majority of ground squirrel control is with a grain bait treated with the rodenticide, chlorophacinone.

The EPA Bulletin described above in the Herbicide Use section covers the rodenticides potentially used under the SMP. Hazard classes relevant to potential SMP rodenticides are shown in the following list. Because the Bulletin is designed to minimize impacts to federally listed species, it does not include other special-status species. Nonetheless, characteristics of the other special-status species included in the EIR that may be adversely affected by rodenticides can be used to determine the appropriate hazard class, and thus use limitations category, for those species. The federally listed species included in the SMP that are also in the Bulletin, if any, are provided first, followed by other special-status species that may be affected by rodenticides (note that an animal may appear under more than one hazard class):

1. CB (Carnivorous Birds): Cooper's hawk, golden eagle, northern harrier, white-tailed kite, long-eared owl, burrowing owl

2. GB (Granivorous Birds): California horned lark, Alameda song sparrow, tricolored blackbird

3. HM (Salt-marsh Harvest Mouse): Salt-marsh harvest mouse, San Francisco dusky-footed woodrat

4. FS (Fossorial Burrowing Species): California red-legged frog, California tiger salamander, California horned lizard, burrowing owl

Table 2 provides the ULC from the Bulletin that apply to the rodenticides potentially used by the District.

As prescribed by BMP 3.21, the District will implement measures to avoid or minimize impacts from rodenticides to non-target species. The Bulletin recommends that the following use limitations be implemented where non-target species may be affected:

> **ULC 1B**. Bait Station Design and Use. Bait stations shall be designed with an opening that prevents access to non-target species (not-to-exceed 3 inches) and controls bait spillage by feeding rodents. See your county agricultural commissioner for recommended designs and suggestions to retrofit existing stations. Bait stations shall be secured (e.g., staked) upright to prevent tipping and access by non-target animals. Bait stations shall not be filled beyond design capacity and in no case shall bait stations be filled with more than 10 pounds of bait.
>
> **ULC 1C**. Station Monitoring. While treated baits are in use, bait stations shall be inspected for spillage, evidence of disturbance by non-target animals, excess moisture from irrigation systems, etc. Problems shall be corrected before baiting is resumed. Any spilled baits shall be promptly cleaned up (scattering limited quantities of spilled bait in non-crop areas is acceptable if allowed by labeling). Bait stations shall be replenished with treated baits as needed to provide continuous exposure. After treated baits are accepted, as evidenced by consumption of baits, depletion of bait in the bait station

shall be inspected at least weekly for depletion of bait and refilled until feeding ceases. Treated baits shall be promptly removed (or bait stations shall be sealed) from all stations after feeding has ceased. If subsequent baiting is needed, a two week period without use of treated baits shall be observed before baiting is resumed. This is to keep the period when treated bait is exposed to a minimum without jeopardizing good pest control.

ULC 1D. Carcass Survey and Disposal. Carcass survey and disposal shall be performed in the treated area beginning on the third day following the initial exposure of toxic baits. Any exposed carcasses shall be disposed of (e.g., completely buried) in a manner inaccessible to wildlife. Carcass surveys shall continue for at least 5 days after toxic baiting has ceased and thereafter until no more carcasses are found. Carcasses should be handled with care to avoid contact with parasites such as fleas.

ULC 5. Use shall be supervised by a person (wildlife biologist, county agricultural commissioner, university extension advisor, state or federal official or others)who is trained to distinguish dens and burrows of target species from those of non-target species. Use shall occur only in the active burrows of target species. The person responsible for supervision shall be aware of the conditions at the site of application and be available to direct and control the manner in which applications are made (per Section 6406 of Title 3, California Code of Regulations). Contact your county agricultural commissioner for information on training.

ULC 7. For commensal rodent control, outdoor use must be in tamper resistant bait boxes placed in areas inaccessible to wildlife.

ULC 34. For commensal rodent control, outdoor use near salt marshes is limited to sites that are separated by at least 10 yards of barren (or clean cultivated) ground from pickleweed habitat or from the inland side of the levee. This buffer strip should be above the high tide line.

Mitigation Incorporated Into the Project

The SMP is intended to incorporate all actions necessary for the District to conduct needed maintenance and reduce impact to an acceptable level. Chapter 4 of the SMP presents policies to protect resources during the implementation of routine maintenance activities. These policies provide guidance to District managers and staff in the environmental review, design, and implementation of individual stream maintenance projects. Mitigation is presented in three areas: (1) overall and specific worksite practices for resource protection termed BMPs, (2) mitigation provided for routine bank protection; and (3) compensatory stream vegetation and special-status species mitigation. The specific measures and how they are designed to minimize or avoid impacts to sensitive biological resources are discussed in detail in the Effects Section.

Best Management Practices

The District has worked for several years to develop a list of BMPs which apply generally to District worksites, whether maintenance or otherwise. These BMPs are incorporated into the SMP (included as Attachment A in this BA) and are adapted to meet the anticipated need for maintenance-specific mitigation. In the FEIR, many of the BMPs were revised in response to comments on the DEIR.

The District will process all routine stream maintenance activities according to the process and protocols established in Chapter 3 of the SMP. The Resource Protection Protocol contained therein includes a step in the annual review process to identify appropriate BMPs for the design and implementation of an activity (Figure 2). BMPs are methods that protect environmental quality or reduce environmental impacts from stream maintenance activities. In order to be effective, BMPs must be properly selected and implemented, applied consistently, and their effectiveness evaluated onsite to assure that they are meeting the required objective. The District's Geographic Information System (GIS) will be developed and enhanced to facilitate the stream maintenance project environmental review, processing, and implementation process, particularly for determining potential presence of sensitive species.

Not every BMP is designed to be used in every situation. Since BMPs are meant to be specific to particular activities and resources, the selection and implementation of an appropriate set of BMPs for each project is a key element to their effectiveness. Because of variation in District facilities and the tendency of individual site conditions to change over time, conditions under which each BMP must be applied cannot be strictly prescribed. The staff involved in design and implementation of the maintenance activity must retain some flexibility to determine which BMPs should be implemented according to design objectives and site conditions.

Selection, implementation, monitoring, and improvement of BMPs are all part of the program. Monitoring of BMPs will be carried out as part of the work and assigned to the lead staff on a particular project as a general rule. The Best Management Practices section of the Stream Maintenance Program is intended to be a living document and to change over the life of the program. The annual Resource Protection Protocol in Chapter 3 of the SMP includes a "lessons learned" step to evaluate and improve all aspects of the maintenance program, including the BMPs. As BMPs are used and ways are seen to improve their effectiveness, they will be modified to reflect the changes. As new BMPs are found or technology improves, the program will incorporate them to further protect resources.

A number of avoidance and compensatory measures aimed at the protection of special-status species have been developed as part of SMP. Attachment A lists all the BMPs proposed under the SMP. Those BMPs which are applicable to special-status species are 1.3, 1.4, 1.5, 1.14, 1.15, 1.16, 2.1 through 2.7, 3.1 through 3.22, 4.5, 4.7, 6.1, 6.4, 6.5 and 6.6. The identity codes for BMPs are included in the text discussion where applicable under the Effects section. Refer to Attachment A for the full language of each BMP.

Under BMP 3.1, the Disrict will develop and distribute informational pamphlets to inform staff about sensitive species. These pamphlets are included in the BA as Attachment D.

Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities

Bank protection is addressed by the Programmatic Impact and Mitigation for Bank Protection protocol which compares the intensity of the work method and amount of hardscape against the environmental sensitivity of the work location. Also addressed in a matrix for assessing the impacts and mitigation needed for bank protection measures. Additionally, a mitigation program has been added to the SMP for bank protection activities that include some form of hardscape or rock (see Attachment C to the BA).

Compensatory Stream Vegetation and Special-Status Species Mitigation

Over the long-term, the SMP has the potential to significantly affect the ecological and biological environment of Santa Clara County by cumulatively affecting special-status species, including their tidal and non-tidal wetland and riparian habitats. Though the implementation of BMPs would reduce these negative effects, adverse negative effects may remain if compensatory mitigation were not provided.

For the purposes of the SMP, compensatory mitigation is mitigation that is to be provided by the District to offset residual negative effects that cannot be avoided through BMPs. To offset negative effects to these species, the District has incorporated compensatory mitigation into the proposed project. The proposed compensatory mitigation measures include a substantial investment towards the protection and enhancement of the watersheds and streams of Santa Clara County. For impacts to stream vegetation from the sediment removal and vegetation management activities, the mitigation package provides the following components: (1) tidal wetland restoration; (2) freshwater wetland creation; (3) stream and watershed protection; and (4) control of giant reed. The four components of the stream vegetation mitigation package are summarized in Table 3, and proposed sites are shown in Figure 3: Proposed Stream Vegetation Mitigation Sites.

The Mitigation Monitoring and Reporting Program (pp. J-3 through J-9, Appendix J of the SMP document as incorporated into the FEIR) provides details on the design of each of these compensatory mitigation features including estimated design and installation dates. Management and monitoring of these compensatory mitigation features is also discussed in general terms where such information is currently available. Several of the mitigation features are currently undergoing design, and monitoring and management will be developed during the design process.

Only some of the compensatory mitigation elements are specifically proposed as mitigation for impacts to threatened, endangered and candidate species. Restoration of 30 acres of tidal wetlands will provide foraging habitat for California clapper rail. Of the approximately 1000 acres which will be purchased and preserved under the stream and watershed protection element, 108 acres will be selected which are known or have the potential to support California red-legged frog. Specific criteria have been developed for identifying watershed land appropriate for mitigating for impacts to red-legged frogs. This criteria is included in the BA as Attachment E.

The removal of giant reed has the potential for impacting some wildlife species. Although giant reed does not support a large amount of wildlife, there may be nesting birds or other wildlife present in the giant reed stands that would be affected during its removal. BMP 3.1 will be implemented prior to the removal of any giant reed to avoid such effects. The Mitigation Monitoring and Reporting Program discusses the circumstances under which replanting of the control sites will be undertaken (pp. B-4 through B-6, SMP Appendix J in the FEIR).

The freshwater wetland creation element of the mitigation program is not specifically proposed as mitigation for impacts to threatened, endangered or candidate species.

An annual report detailing what routine stream maintenance work was accomplished in the prior construction season will be submitted to the District's Chief Executive Officer, the US Army Corps of Engineers, the US Fish and Wildlife Service, California Department of Fish and Game, San Francisco Bay Conservation and Development Commission, National Marine Fisheries Service, the San Francisquito Joint Powers Authority and the Regional Water Quality Control Boards at the end of the maintenance season (prior to January 1) which will specify which projects were completed for the year including type of work, location, and size of the project. Sediment removal, vegetation management, and bank protection work which have been repeated under the SMP will be distinguished from areas where such work is being undertaken for the first time under the SMP. Any modifications of BMPs recommended at the annual lessons learned meeting will be summarized in the annual report.

In addition to reporting on the maintenance activity completed for the year, the District will also provide reporting on the implementation of the mitigation program, including maps showing the location of compensatory mitigation sites, a description of the current stage in the planning and implementation schedule, progress towards success criteria, and a general summary of maintenance of mitigation sites. As specified in BMP 3.1, the results of all sensitive species surveys will be reported to USFWS, NMFS and the California Department of Fish and Game in the annual report.

For the first 5 years of the program, the District will provide the agencies with a tour of representative work areas for that year and all mitigation sites. This tour will take place after completion of the work season. Preconstruction photographs will also be provided. The District's GIS may be utilized as a tool for reporting annual work activities and implementation of mitigation projects.

ACTION AREA

The area to be affected directly or indirectly by the SMP includes all streams and canals within the District's jurisdiction, with the following exclusions: sediment removal and vegetation management on stream reaches above the 1,000-foot elevation contour which is above the reservoirs; hardscape bank protection projects which occur in high quality fisheries habitat or existing high quality riparian habitat; any sediment removal, wetland vegetation control, or removal of in-channel trees in Llagas Creek downstream of Highway 152 to the confluence with the Pajaro River and in the Pajaro River within Santa Clara County; and any flood control projects that are not routine maintenance such as CIP. Usually the maintenance work area is within approximately 20 feet of the top-of-bank when access is provided, and can be substantially less when access is not provided. Leveed creeks require a wider maintenance easement.

SURVEYS AND MONITORING PERFORMED BY THE DISTRICT

Surveys for certain special-status species are routinely conducted by the District. The purpose of the surveys is to obtain information on the local distribution and abundance of special-status species and to assess the habitat suitability for special-status species for specific project sites. The District maintains informational databases for many of the special-status species that occur in the action area. The following discussion summarizes previous and on-going surveys and monitoring efforts performed by the District.

Special-Status Plant Surveys

Information on known occurrences for special-status plant species used in this analysis was obtained from CNDDB, the California Native Plant Society's (CNPS) electronic inventory, information from local botanists, including members of the Santa Clara Valley Chapter of CNPS, and District staff. No comprehensive special-status plant surveys have been conducted in the action area.

Fisheries Surveys

The District has conducted several types of fisheries surveys to meet specific information needs on a limited-term basis. The surveys do not represent a comprehensive or longer-term fish monitoring program and were not intended as such. A variety of survey methods have been used by the District to detect salmonids, including electro-fishing, adult migrant trapping, smolt (juvenile fish) trapping, and redd (a site in which salmonid eggs have been laid) surveys. Most of these surveys have been conducted on the Guadalupe River and Coyote and Stevens Creeks. Fisheries habitat typing was performed in the Lower Guadalupe River in 1997 and 1998, following the methodology in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). In 1999, habitat surveys were conducted in Guadalupe River, Coyote Creek, and Stevens Creek up to the reservoirs and along some of the tributaries. Other general surveys that relate to habitat quality for salmonids include: collection of stream temperatures, reservoir profiles, barrier mapping, and evaluation of the ephemeral nature of creeks.

Fish Habitat Categories

The streams of Santa Clara Valley can be loosely classified into eight categories according to their fish species compositions and potential habitat values for fish. These categories, which are described in detail below, are: Trout (7), Steelhead (6), Potential Trout (5), Warm Native (4), Mixed Spawning (3), Native/Introduced (2), Limited (1), and No Regular Value (0) (See Figure 4, Table 4). Adequate data on fish and habitat conditions exist to allow assignment of these fish categories to approximately 344 miles of the 828 miles of stream within the District's jurisdiction.

The "No Habitat Category Data" category in Table 4 is assigned to stream reaches where not enough information is available to assign a category relative to fish habitat. Most of the remaining stream miles occur in small or urbanized streams; many of these probably have relatively low values for fish. These habitat designations are for assessing general program impacts only, not for accurately assessing impacts of individual stream maintenance activities.

Descriptions of the fish habitat categories are based upon presence of significant fisheries, habitat rarity, sensitivity to impact, or impact to species of limited population distribution. Significant fisheries are present if priority species (rainbow trout, steelhead, chinook salmon) use, or potentially could use, the habitat for spawning or rearing. Significant fisheries also exist where native warm water fish presently, or potentially, dominate the fish community (categories 3-7). Even lower quality habitats (categories 1-2) can be considered to have significant fisheries values if they provide migration passage for native juvenile and adult fish. Some of these lower category stream reaches also have the potential to be restored in the future for use by priority species or native warm-water fish.

Resident Trout (7)

Upstream of barriers to steelhead spawning migrations, resident rainbow trout can be present in the cooler, permanent streams. This category includes most headwater streams, except those in the dry southeast portion of the county, and accounts for about 6% of District stream miles with recorded fish habitat categories. In smaller streams with natural barriers, habitats are generally steep and well-shaded. These streams, including upper Bodfish Creek, a tributary to Uvas Creek, contain only rainbow trout and riffle sculpin. In larger streams or flatter streams, the upstream migration barriers are more likely to be man-made (dams, flood control drop structures). Other species usually present with the trout and riffle sculpins in these streams are California roach *(Hesperoleueus symmericus)* and often Sacramento suckers *(Catostomus occidentalis)*; typical streams include Stevens and Uvas Creeks upstream of their reservoirs, and Saratoga Creek within and upstream of the town of Saratoga. Most resident trout habitat is upstream of Lexington, Guadalupe, Almaden, and Anderson Reservoirs in streams subject to District jurisdiction, but where stream maintenance generally does not occur.

Steelhead (6)

These streams provide regular or frequent access for spawning steelhead and regularly provide rearing conditions for juvenile steelhead (about 12% of District stream miles with recorded fish habitat categories). Streams are usually well-shaded and cool (San Francisquito, Bodfish, Little Arthur, and Tar Creeks), or else have substantial augmented flows from reservoir releases (Uvas Creek from the dam downstream to Highway 152 and Stevens Creek from the dam downstream to Fremont Road). In addition to steelhead, other species present include those listed for resident trout streams and also, in some cases, threespine stickleback and Sacramento pikeminnow *(Ptychocheilus grandis).*

In Stevens Creek downstream of the reservoir and Upper Penitencia Creek within and immediately downstream of Alum Rock Park, resident rainbow trout occur with anadromous steelhead. Difficult steelhead access in some years probably prevents complete replacement of resident trout by steelhead. In Guadalupe, Alamitos, Arroyo Calero, and Coyote Creeks downstream of their reservoirs, recent laddering of barriers (Blossom Hill drop structure and Metcalf Dam) allows steelhead and chinook salmon access to what has been trout habitat.

Warm-water Native Fish/Potential Steelhead or Trout(5)

In warmer (greater than 70 degrees), relatively natural, less-shaded streams, native warm-water fish usually dominate; abundant species include California roach, Sacramento sucker, Sacramento pikeminnow, and, downstream of reservoirs, hitch (*Lavinia exilicauda*). Abundant summer streamflows in wetter years, however, especially from reservoir releases for percolation, provide potential fast-water feeding habitat for juvenile steelhead. The fast-water habitat allows for potentially good densities and growth by juvenile steelhead or resident rainbow trout, despite the increased food demands from higher metabolic rates due to the warmer water. Chinook salmon may also use these habitats for spawning, with juvenile fish out migrating prior to warm summer temperatures. These habitats include middle or lower reaches of Stevens, Saratoga, Guadalupe, Alamitos, Upper Penitencia, and Coyote Creeks, accounting for about 9% of District stream miles with recorded fish habitat categories. Pacheco and Llagas Creeks downstream of Pacheco and Chesbro Reservoirs provide periodic steelhead habitat, although steelhead outmigrant passage due to low spring streamflows is a problem on both streams.

Warm-water Native Fish (4)

About 6% of stream miles with recorded fish habitat categories support predominantly native warm-water fishes. The warmer, downstream portions of Alamitos, Uvas, Llagas, and Pacheco Creeks, downstream of their reservoirs, cannot support steelhead because of low flows and/or warm-water, but do support large populations of native fish, including California roach, Sacramento suckers, and often hitch, Sacramento squawfish, and Sacramento blackfish (*Orthodon microlepidotus*). Prickly sculpin (*Cottus asper*) and threespine stickleback are also commonly present. In wetter years, non-native reservoir fishes (largemouth bass, bluegill (*Lepomis macrochirus*), goldfish (*Carassius auratus*), threadfin shad (*Dorosoma petenense*) may enter these stream sections due to reservoir spilling, but they usually do not reproduce or persist long. Upper Silver Creek is a small, natural, generally unshaded stream with perennial flow (it runs in the Silver Creek Fault Zone). It contains only native threespine stickleback and California roach and is one of the few area streams that is both depauperate in native species and lacking introduced species.

Mixed Introduced/Native with Salmon Spawning (3)

Chinook salmon presently use the lower portions of Coyote Creek, the Guadalupe River, and occasionally Los Gatos Creek for spawning, accounting for about 7% of District stream miles with recorded fish habitat categories. Summer water temperatures and/or water quality are usually not suitable for summer salmonid rearing because of unshaded conditions, urban runoff, and low streamflows. However, juvenile chinook salmon may outmigrate to the Bay in spring before conditions deteriorate. Lowered water quality (high temperature, low dissolved oxygen, and turbidity) and abundant slow pools in these lower stream reaches usually shift species composition towards non-native species. Native Sacramento sucker and California roach and/or hitch are usually found at the salmon spawning sites. Likely introduced fishes include carp *(Cyprinus carpio)*, goldfish, and mosquitofish *(Gambusia affinis)*. In Coyote Creek, the introduced and very adaptive red shiner (*Notropis lutrensis*) and fathead minnow (*Pimephales promelas*) are often the most abundant fish.

Mixed Native/Introduced Fish (2)

Introduced fish species are likely to be at least as abundant as native species in about 18% of District streams with recorded fish habitat categories. This species composition is especially common where water quality is impaired (lower Llagas Creek and the Pajaro River in south county or Lower Penitencia, lower Matedero, and lower San Francisquito Creeks in the north county). Fisheries values are also relatively low where the habitat has been severely modified (channelized, with no pools or riparian vegetation), even if flows are perennial and water quality is not impaired (Canoas Creek). Since most of the introduced species prefer slower water, they are also likely to become dominant where percolation ponds provide abundant source populations from which these species disperse into streams. The effect is probably greatest where ponds usually remain in place for several years (Almaden Lake, Metcalf Pond, and Penitencia Creek Percolation Ponds) rather than where the ponds are removed annually (such as the formerly utilized seasonal percolation ponds on the Guadalupe River and Los Gatos Creek). Seasonal percolation ponds (which are not currently being used by the District) on streams without reservoirs (Saratoga Creek) or without substantial channel modifications (Stevens Creek) remain dominated by native fish species (categories 5 and 7).

Limited Fish Resources (1)

Many valley streams, especially smaller ones in urbanized areas or those in the drier southeast portion of the county, have been channelized and generally have only seasonal surface water; these habitats constitute about 26% of the stream miles in the District with recorded fish habitat categories. Some stream sections (lower Los Gatos Creek and Coyote Creek between Tully Road and Hellyer Park) serve as potential migration pathways for chinook salmon and steelhead. Others (most of Calabazas, Golf, and San Tomas Aquino Creeks) have limited fish values because they go dry in the summer of most years. They may provide habitat for fast-developing amphibians such as Western toads *(Buso boreas)* or Pacific tree frogs *(Chyla regilla).*

No Regular Value (0)

Some streams have surface flow only during storm events (Randol Creek and some of the tributaries to Little Llagas Creek). Such streams account for 16% of the stream miles in the District with recorded fish habitat categories. They do not provide habitat for fish or even for amphibians in most years.

Table 5 quantifies fish habitat Categories 0-7 by channel type: Natural (+/-), Mixed, and Concrete. Natural (+/-) channels may have some modification to the flood plain but have no modification of the stream channel or stream banks. The (+/-) thus stands for more or less natural. Mixed channels are engineered or otherwise modified streams where the stream bottom is earthen, but the banks have a variety of conditions, including excavated earth, earth levees, rock, gabions, sack concrete, or flood walls. Concrete channels have a concrete bottom and may have either concrete or earthen banks. The District has not recorded the channel type for 306 miles of streams within its jurisdiction, which are thus not categorized. Data has not been recorded on these uncategorized streams because they do not have engineered designs, and the District does not systematically collect information on non-engineered streams. The District estimates that the majority of these unrecorded stream miles are Natural (+/-). The fish habitat type is not known for 178 miles of channels that have been categorized by channel type. Natural (+/-) channels, which include the majority of District channels with recorded channel type conditions, contain most of the known fish habitat of all categories mapped within the District. About 98% of the steelhead habitat and almost 100% of the resident trout habitat occur in such channels.

California Red-Legged Frog Surveys

Beginning in 1996, the District has surveyed portions of the action area for California red-legged frogs using USFWS protocol (USFWS 1995, 1997). Approximately 80 percent of the streams in the action area with suitable habitat and access available to the District have been surveyed (Figure 5: Critical Habitat and Red-Legged Frog Occurrences in the Multi-Year Stream Maintenance Program Area). Areas in the foothills and mountain ranges have been less thoroughly surveyed due to difficulty accessing private land. The District has identified most of the county's ephemeral creeks that are thought to exclude red-legged frog breeding habitat due to the absence of surface water during the tadpole rearing season. Historical occurrences, currently occupied locations, and creek sections that are considered unsuitable breeding habitat for red-legged frogs are recorded in the District's database. The District has also conducted surveys at each of its diversion structures when these structures are installed and removed. No red-legged frogs have been found adjacent to the diversion dams or in the percolation ponds since this monitoring began in 1997.

Bird Surveys

The District has conducted surveys for California clapper rail, least Bell's vireo, western snowy plover, and burrowing owl. California clapper rail surveys have been conducted prior to maintenance activities in suitable habitat since 1996. Clapper rail survey methods include two days of passive listening in suitable habitat between March 1 and April 15. If rails are not detected through passive listening, taped vocalizations are used to elicit a response. Beginning in 1997, least Bell's vireo surveys have been conducted weekly along sections of Llagas during May and June. Surveys for western snowy plovers have been conducted at potential project sites that contain suitable habitat. Surveys for burrowing owls occur in suitable habitat where maintenance activities are scheduled. District biologists have also monitored known owl nesting locations in the action area since 1995.

SPECIES ACCOUNTS AND STATUS OF THE SPECIES IN THE ACTION AREA

The species are discussed in the order they are listed on page 2 of this document.

Threatened, Endangered, and Candidate Species

Saltmarsh Harvest Mouse

The saltmarsh harvest mouse is federally and state listed as Endangered and is Fully Protected under the California Fish and Game Code. Saltmarsh harvest mice inhabit the middle to upper levels of dense pickleweed stands in tidal and diked coastal salt marshes around San Francisco Bay and its tributaries. During high tides, they will use tall vegetation to escape inundation. Their population has been reduced due to loss of the extensive marsh habitat that historically surrounded San Francisco, San Pablo, and Suisun Bays (BioSystems 1994).

The distribution of saltmarsh harvest mouse in the Santa Clara County includes salt marshes in the southern portion of San Francisco Bay. Specific locations include the salt marshes associated with Coyote and Stevens Creeks, Alviso, Mayfield, and Guadalupe Sloughs, Palo Alto marsh and other locations dominated by dense pickleweed (District, unpublished data;

CNDDB 2000). (Figure 6: Salt-Marsh Harvest Mouse Occurrences in the Multi-Year Stream Maintenance Program Area).

A recovery plan for the saltmarsh harvest mouse was approved in 1984, but critical habitat has not been designated (USFWS 1984b).

Western Snowy Plover

The western snowy plover is federally listed as Threatened and is a California Species of Special Concern. For nesting, they use barren or sparsely vegetated marine and estuarine shorelines, and other salt-influenced areas, such as salt evaporation ponds and levees (USFWS 1993). The breeding season for western snowy plover nests is defined as early March through September (USFWS 1999). Western snowy plovers historically inhabited coastal beaches along the Pacific coastline, but the current population is fragmented throughout the range due to loss of habitat from encroachment of introduced beachgrass and urbanization, nest predation, and human disturbance (USFWS 1993).

Within Santa Clara County, western snowy plovers have been reported during the breeding season at the salt evaporator ponds adjacent to Guadalupe, Alviso, and Artesian (Mallard) Sloughs, and on levees adjacent to Moffett Field. During the non-breeding season, they have been observed at Crittenden and Calabazas Marshes, salt evaporator ponds adjacent to Guadalupe and Alviso Sloughs, and Coyote Creek (District DEIR 2001) (Figure 7: Snowy Plower Nest Locations in the Multi-Year Stream Maintenance Program Area).

Critical habitat for the western snowy plover, designated in 1999, does not included any portions of Santa Clara County (USFWS 1999).

California Clapper Rail

The California clapper rail is federally and state listed as Endangered and is Fully Protected under the California Fish and Game code. California clapper rails are found year-round in saltwater marshes and tidal sloughs that are dominated by pickleweed (*Salicornia* spp.) and cordgrass (*Spartina* spp.). Clapper rails require dense vegetation for cover and nesting. They are known to occur only in the marshes and sloughs surrounding portions of San Francisco, San Pablo, and Suisun Bays. Historically, California clapper rails occurred in coastal salt marshes from Humboldt Bay in northern California to Morro Bay in central California (BioSystems 1994). Loss of habitat through urbanization and diking of wetlands have caused a major decline in the California clapper rail population. Predation by introduced species such as red fox, Norway rat, and feral cat, has also contributed their population decline (BioSystems 1994). The California clapper rail breeding season is defined as 1 February through 31 August, which encompasses courtship and late breeding and nesting activities.

Known occurrences of California clapper rails in Santa Clara County include suitable habitat associated with Alviso, Guadalupe, and Charleston Sloughs (CNDDB 2000). Other local areas that support California Clapper rails include: the Palo Alto Baylands; the outboard levee of the Palo Alto Flood Basin; the north side of San Francisquito Creek; and Stevens and Permanente

Creeks (Figure 8: California Clapper Rail Occurrences in the Multi-Year Stream Maintenance Program Area).

A recovery plan for the California Clapper Rail was approved in 1984, but critical habitat has not been designated (USFWS 1984b).

Least Bell's Vireo

The least Bell's vireo is federally and state listed as Endangered. Least Bell's vireos nest primarily in riparian habitat dominated by willows. The breeding season is from March through September (USFWS 1998b). They were once widespread and abundant in dense riparian areas throughout the Central Valley and other low elevations throughout California (USFWS 1994). However, the statewide population has declined drastically due to loss of riparian habitat and nest parasitism by brown-headed cowbirds (*Molothrus ater*) (USFWS 1994). Current breeding populations occur in eight southern California counties, with the majority of birds occurring in San Diego County. Many of the southern California populations are now expanding or stable due to habitat protection and on-going brown-headed cowbird control programs (USFWS 1994).

Although areas of suitable habitat occur throughout Santa Clara County, it was believed that the last known breeding record of least Bell's vireos in Santa Clara County was in the 1930's (D. Padley, District, pers. comm. 2001) and they were locally extirpated in the 1980's (USFWS 1994). However, a nesting pair was discovered along Llagas Creek, upstream of the confluence with the Pajaro River in 1997 (District, unpublished data, Figure 9) . In May 2001, two males were heard singing along lower Llagas Creek, but no other breeding activities were observed. A fledgling vireo was observed in Monterey County north of Salinas in the vicinity of Echo Valley in 2001, approximately 10 miles from the Pajaro River in Santa Clara County (Caltrans unpubl. data 2001).

A draft recovery plan has been prepared for least Bell's vireos, but has not been approved (USFWS 1998b). Critical habitat for the species was designated in portions of six counties in southern California. No areas within Santa Clara County were designated as critical habitat; the nearest critical habitat to the action area is in Santa Barbara County (USFWS 1994).

San Francisco Garter Snake

The San Francisco garter snake is federally and state listed as Endangered and is Fully Protected under the California Fish and Game code. This species inhabits natural or artificial wetlands, such as streams, marshes, stockponds, and irrigation ponds, where adequate prey is available. San Francisco garter snakes also use adjacent upland habitats for foraging and, during the winter months, for hibernating. Historically, they ranged throughout much of the San Francisco peninsula and San Mateo County. Much of the San Francisco garter snake's habitat has been eliminated by urbanization and agricultural development (BioSystems 1994). In Santa Clara County, there are four recorded occurrences of San Francisco garter snakes (HT Harvey 1999a, Table 6) These occurrences are from the San Francisquito and Adobe Creek watersheds in the northwestern portion of the District (Figure 10: San Francisco Garter Snake Occurrences in the Multi-Year Stream Maintenance Program Area). One occurrence in Palo

Alto was presumed extinct in 1920. The other three occurrences were presumed extant, but since the records are almost 20 years old, they should be viewed with caution. Two populations were recorded the Stanford University Campus on the Stanford University Campus in the Lake Lagunita area, which is 3,500 ft east of San Francisquito Creek. The area between Lake Lagunita and San Francisquito Creek is bisected by several roads including Junipero Serra Road, Sand Hill Road, Campus Drive West and Fremont Road. In addition to the roads, the Stanford Golf Course is located between Lake Lagunita and San Francisquito Creek. The third record is from San Francisquito Creek at Junipero Serra Road in an area located approximately 1,500 ft upstream of any District work activities. The SMP work area is located downstream of Sand Hill Road. During the summer months when the work is to be conducted within the creek, San Francisquito Creek is dry downstream of El Camino Real and does not provide habitat for the San Francisco garter snake. Areas between El Camino Real and Sand Hill Road do remain wet during the summer months. There are no records of San Francisco garter snakes in this area and recent surveys by the District indicate there are no California red-legged frogs in this area either (District unpubl. data).

A recovery plan for San Francisco garter snakes was approved in 1985, but critical habitat has not been designated (USFWS 1985).

California Red-Legged Frog

The California red-legged frog is federally listed as Threatened and is a California Species of Special Concern. California red-legged frogs inhabit dense, shrubby, riparian vegetation associated with deep, slow moving water. Although individuals can occur in seasonal streams and ponds, reproducing populations probably cannot be maintained if surface water disappears entirely anytime during the breeding season (March-July) (Jennings and Hayes 1994). California red-legged frogs were once common throughout most of lowland California. Habitat loss and degradation through agriculture, urbanization, mining, overgrazing, recreation, timber harvesting, non-native plants, impoundments, water diversions, degraded water quality and introduced predators, including bullfrogs and non-native fish, have drastically reduced populations of this species throughout its range (USFWS 2000a). Since the early 1900's, California red-legged frogs have disappeared from many urbanized lowland areas, as well as brackish marshes bordering San Francisco Bay; the remaining riparian habitat in this area is largely channelized or contains non-native predatory fishes and bullfrogs (USFWS 2000a). Red-legged frog populations in the action area are primarily found in the streams in the foothill and mountain ranges of Santa Clara County. This species is considered extirpated from most of the streams in urban portions of the action area (Figure 5: Critical Habitat and Red-Legged Frog Occurrences in the Multi-Year Stream Maintenance Program Area).

USFWS recently designated critical habitat for California red-legged frog including 216,966 acres of land in eastern and southern Santa Clara County. No critical habitat has been proposed in the District's proposed work area (USFWS 2001). The draft USFWS strategy for recovery of California red-legged frogs includes protecting existing populations, restoring and creating habitat, surveying and monitoring populations, and re-establishing populations within the historic range. Santa Clara County is in recovery Unit 4 (South and East San Francisco Bay) and Unit 6 (Diablo Range/Salinas Valley). No core areas are in the proposed action area. The Coyote Creek watershed in the vicinity of Henry Coe State Park and San Luis Reservoir have been identified as having high recovery potential (USFWS 2000a). These areas are outside the action area for this project.

California Tiger Salamander

The California tiger salamander is a federal candidate for listing and a California Species of Special Concern in California, with the exception of Santa Barbara County, where they are listed as Endangered (USFWS 2000d). California tiger salamanders inhabit grasslands and open oak woodlands and breed in long-lasting vernal pools (i.e., low-lying areas that pond following rain) and artificial stock ponds that remain inundated for at least 10 weeks (Jennings and Hayes 1994). They also frequently breed in artificial habitats, such as stock ponds and agricultural irrigation ponds, but require breeding pools that are free of predatory fish (USFWS 2000d). California tiger salamanders require ground squirrel or other mammalian burrows within 1 mile of breeding habitats for refuge during dry, hot weather (Jennings and Hayes 1994). Loss of vernal pool sites and refuge habitat due to grazing, agriculture, suburban development, and poisoning of burrowing mammals threaten California tiger salamander populations. In addition, introduced predators, such as bullfrogs (*Rana catesbeiana*), mosquitofish, and Louisiana red swamp crayfish (*Procambarus clarkii*), have extirpated some local populations (Jennings and Hayes 1994).

In Santa Clara County, populations remain in the lowland areas where suitable breeding and estivation habitat occur, such as Communication Hill and Cerro Plata (HT Harvey 1999b, Figure 11). In the rest of the county, salamanders are known to occur in foothill and mountain ranges. The populations at some of these locations, such as at Anderson Reservoir and North Fork Pacheco Reservoir, are composed entirely of introduced tiger salamanders (*Ambystoma tigrinum*) that originated from locations in the central and eastern part of the United States, not California tiger salamanders. These introduced populations are presumably the result of past bait bucket introductions by fishermen or the deliberate stocking of aquatic habitats to create a nearby source of live bait for bass fisherman (HT Harvey 1999b).

Steelhead

District managed streams lie geographically within two distinct steelhead population segments (Busby et al. 1996). Streams tributary to San Francisco Bay are included in the Central California Coast ESU and streams tributary to the Pajaro River in the southern part of the District are included in the South/Central California ESU as defined by the NMFS. The NMFS has designated steelhead trout in both the Central California Coast ESU and South/Central California ESU as federally Threatened species (NMFS 1997). The South/Central California ESU is also a California Species of Special Concern. At this time, the designation applies only to naturally spawned populations of anadromous forms of *O. mykiss* residing below long-term naturally occurring or man-made impassable barriers. All accessible streams in these areas have been designated as critical habitat by NMFS (NMFS 2000).

O. mykiss exhibit a variety of life-history patterns including residents (non-migratory) at one extreme and individuals that migrate to the open ocean (anadromous) at another extreme. Individuals that mature and spawn without migrating to sea are known as resident rainbow trout while those that migrate to sea are known as steelhead. They are however, the same species and in California, many streams support both resident and anadromous forms with no observable genetic differentiation. Anadromous steelhead in District streams are of the ocean maturing type that enter spawning streams during the fall and winter in fully mature state and spawn relatively soon after entering fresh water.

Steelhead habitat requirements depend on life history stages including migration from the ocean to inland reproductive and rearing habitats, spawning and egg incubation, rearing, and seaward migration of smolts and spawned adults. Steelhead along the Central California coast enter freshwater to spawn when winter rains have been sufficient to raise streamflows, generally from late-October through the end of May, but typically the bulk of migration occurs between mid-December and mid-April (Shapovalov and Taft 1954). Unlike other Pacific salmon, steelhead may survive after spawning and return downstream to re-enter the ocean.

Steelhead spawn in gravel substrate with sufficient flow velocity to maintain circulation through the gravel and provide a clean, well-oxygenated environment for incubating embryos. After emerging from the gravel, fry inhabit low velocity areas along the stream margins. As they feed and grow they gradually move to deeper and faster water. Heads of pools generally provide classic conditions for older juveniles. Coastal steelhead can inhabit quite small streams. Often habitat for older fish may be far more limited than habitat for younger fish. Escape cover in the form of undercut banks, boulders, tree roots, fallen trees, and overhanging vegetation is a critical component of steelhead trout habitat.

Smith (1999) describes two different habitat types used by central coast steelhead and resident trout. The primary habitat is shaded pools of small, cool low-flow upstream reaches typical of original steelhead habitat in the region. In addition, they can use warmwater habitats below some dams or pipeline outfalls, where summer releases provide high summer flows and fast-water feeding habitat. Higher flows can result in an increase in drift of aquatic invertebrates used by trout for food. At high rates of food consumption, trout can sustain the higher metabolic rate required in warmer water. Therefore, under augmented flow conditions trout can occupy warmer habitats than may otherwise be possible (Smith and Li 1983).

Juveniles that become migratory typically do so after one or two years of rearing but sometimes longer. Physiological changes (smoltification) in these fish (smolts) ultimately allow them to make a transition from freshwater to seawater. Smolts migrate to the ocean, spend a variable amount of time there (typically one to two years), grow rapidly and return to spawn, generally in the stream where they hatched. Although trout of various ages may migrate downstream in all months of the year, the majority migrate in April, May, and June.

Smith (1998, 1999) has extensively evaluated steelhead use and habitat conditions in streams of the Santa Clara Valley and this work is summarized here. Figure 4 indicates areas currently usable by steelhead as well as areas above barriers that are currently defined as coldwater habitat supporting trout but that historically could have supported steelhead. Steelhead habitat currently occurs in 9% of stream miles in the Santa Clara Basin for which fish habitat has been categorized and 3% of stream miles in SCVWD managed streams draining to the Pajaro River (Table 4).

Historically, steelhead would have used the Guadalupe River system, including the Guadalupe River, Alamitos Creek, Upper Los Gatos Creek, and in wetter years, Arroyo Calero (Smith 1999). However, with the construction of reservoirs, low flow crossings, bridge aprons, and un-shaded, flood protection channels, access to favorable habitat in upstream reaches was severely limited and steelhead are no longer common in the system (Smith 1999). Several District projects have been directed at identifying fish passage impediments and incorporating solutions as mitigation for other District impacts.

Calabazas Creek, Saratoga Creek, and San Tomas Aquino Creek are all channelized in their lower reaches before joining with Guadalupe Slough and discharging to San Francisco Bay. Calabazas and San Tomas Aquino Creeks historically may have supported steelhead but no longer do so (Smith 1999). Saratoga Creek also likely supported steelhead populations due to its high summer streamflows and large watershed, but grade control structures downstream currently prevent access (Smith 1999). Adequate spring flows are not available for outmigration of steelhead smolts in Saratoga Creek even if access to the perennial upper sections of the creek were possible for spawning (Smith 1999).

Steelhead regularly use perennial sections of San Francisquito Creek, Bear Gulch Creek, and Los Trancos Creek but upper portions of San Francisquito Creek are blocked due to the construction of Searsville Dam in 1902. The success of juvenile steelhead outmigrating through San Francisquito Creek may be compromised by low flows during late spring (Smith 1999).

Three large fish ladders provide access for spawning steelhead to upstream sections of Stevens Creek; however, much of the upper watershed was blocked from access in the 1930's with the construction of Steven Creek Reservoir. The ladders do not allow adequate passage at all times due to clogging by debris and sediment deposition. Successful spawning does occur although suitability for smolt outmigration in the spring is largely dependent on reservoir releases (Smith 1999).

Steelhead in the Coyote Creek system used the whole watershed historically but are now confined to Upper Penitencia Creek, with the most use in Alum Rock Park (Smith 1998). Many portions of the stream are intermittent or dry during the summers due to water management operations. Although steelhead are able to rear in Upper Penitencia Creek conditions for out migration can be limited by low flow due to diversions. Potential habitat exists in the reach of Coyote Creek immediately downstream of Anderson Dam although in other areas of Coyote Creek, rearing habitat is of marginal quality due to poor water quality (e.g., warm temperatures due to riparian vegetation removal), low flows, and groundwater percolation operations. Historically, the lower gradient reach of Coyote Creek on the valley floor supported species typical of warm, slow water habitats (Smith 1999).

In the Pajaro River Basin portion of the District watershed, Uvas Creek and Llagas Creek support steelhead and Pacheco Creek supports remnant steelhead runs. As with the other streams in the region, downstream passage by steelhead smolts in Pacheco Creek is greatly hampered by low streamflows during the spring, adversely impacting the success of these runs (Smith 1998).

Habitat alteration in streams of the Santa Clara Valley have resulted primarily from urbanization, agriculture, flood protection, and water management practices. Urbanization has resulted in removal of riparian vegetation and confinement of streams within restricted and realigned channels. Increased presence of hardscape in the form of asphalted roadways, parking lots, and buildings together with channel modifications have resulted in altered runoff patterns and concrete channels. Drainage of urban areas creates very high peak flows and these pulses in high flows tend to destroy any redds that may have been established in areas such as the lower sections of the Guadalupe River (Smith 1999).

Channel modification for flood protection has occurred primarily in lower gradient, urbanized areas and resulted in removal of riparian vegetation, un-shaded banks, and warm, shallow channels. Steelhead smolts are subject to increased temperature in these channels and predation from larger predatory fish such as pikeminnow (squawfish) and birds, particularly cormorants, mergansers, and herons. Flood protection channels typically have wide, shallow configurations that are largely devoid of in-stream large woody debris and riparian vegetation. The lack of escape cover may increase the potential for high rates of predation on smolts. Predation by fish can also be high below dams, drop structures, and other channel modifications. In these situations, migrating smolts can be disoriented in turbulent flows and predators may congregate and feed on them.

Chinook Salmon

The Santa Clara Valley watershed lies geographically within the California Central Valley Fall-run (ESU) as defined by the NMFS (Busby et al. 1996). On September 16, 1999, NMFS determined that listing was not warranted for this ESU. However, the ESU is designated as a candidate for listing due to concerns over specific risk factors. Chinook salmon in the California Central Valley Fall-run ESU are also a California Special Concern (CSC) species. At this time, the ESU includes only naturally spawned populations of fall-run chinook salmon (not hatchery populations).

The SMP is also subject to consultation on effects to salmon Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Management Act. Provisions of the Act would apply to chinook salmon habitat in Coyote Creek, Guadalupe River, and other areas potentially used by chinook salmon. Under Section 305(b)(4) of the Act, NMFS is required to provide advisory EFH conservation and enhancement recommendations to Federal and state agencies for actions that adversely affect EFH. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity and includes freshwater habitat currently viable and most waters historically accessible to salmon. Freshwater EFH for chinook salmon consists of four major components, (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and adult holding habitat. Important features of essential habitat for spawning, rearing, and migration include adequate (1) substrate composition; (2) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (3) water quantity, depth, and velocity; (4) channel gradient and stability; (5) food; (6) cover and habitat complexity (e.g., large woody debris, pools, channel complexity, aquatic vegetation, etc.); (7) space; (8) access and passage; and (9) flood plain and habitat connectivity.

Habitat upstream of longstanding naturally impassable barriers and certain listed impassable barriers (dams) are excluded from salmon EFH, however activities in non-EFH areas are included if they may effect EFH downstream. Under a programmatic consultation, NMFS provides the Federal agency (e.g. the Army Corps of Engineers) with advisory EFH conservation recommendations and identifies any adverse impacts that could not be addressed by the recommendations. If the Federal agency adopts measures for avoiding, mitigating, or offsetting the impact of the activity on EFH that are inconsistent with the programmatic consultation recommendations, the Federal agency must explain its reasons for not following the recommendations.

Habitat for fall-run chinook salmon tends toward larger rivers such as the Sacramento and San Joaquin Rivers. Hatchery production and management practices in the Central Valley have resulted in production of large numbers of juvenile chinook salmon with poorly developed homing instincts that tend to stray as returning adults. Chinook salmon observed in the Santa Clara Valley watershed are likely strays from these Central Valley stocks. This species does not occur in earlier historical records for the region; however, migrating adult salmon have been observed in the Coyote and Guadalupe Rivers since at least the mid-1980's (Smith 1999). Smolts have now been captured from the Guadalupe River and Coyote Creek (Jae Abel, District Fishery Biologist, personal communication, January 2001), which indicates that some natural spawning is successful. In addition, in the 1980's, there were reports of chinook salmon carcasses in Lower Calabazas Creek, which indicates that spawning may have occurred there (Smith 1999). Areas in SCVWD managed streams potentially used by chinook salmon are indicated in Figure 4 (depicted as mixed/spawing). These areas include 7% of stream miles where fish habitat has been categorized in the Santa Clara Valley but do not include SCVWD streams draining to the Pajaro River (Table 4).

Adult fall-run chinook salmon migrate from the ocean to upstream spawning areas primarily in the late summer and early fall and spawn from late October into December. Adult chinook salmon have been captured as early as early August in Coyote Creek and mid-July in Guadalupe River, although the majority appear to have migrated between late September and mid-November. Chinook salmon adults stop feeding when they enter fresh water and die after spawning. Spawning habitat consists of gravel and small cobble substrates (0.5 to 6 inch diameter) with relatively swift water velocity (ideally in the range of 1 to 3 feet per second). Such conditions are often found at the head of riffle areas, often in relatively shallow water. Survival of developing eggs and fry is dependant on cool water temperature (less than 15 C), high levels of dissolved oxygen (at least 7 mg/l), water velocity that is relatively stable and near the level at time of spawning, and good gravel permeability.

One of the main factors influencing egg hatching success in Santa Clara Valley streams is that the flashy nature of the streamflows, i.e., high initial pulses of runoff due to an urbanized watershed, may destroy the eggs. Peak flows exceeding 2.5 times the average annual daily flow may become increasingly destructive (Raleigh et al. 1986). Also, the presence of fine sediments in riffle-run areas can adversely affect embryo survival, food production, and escape cover for juveniles.

Fall-run fry generally emerge from the streambed around March and rear in the river for a short period. Some fry may move downstream soon after hatching and rear in downstream reaches or the estuary, particularly in wet years. Rearing juveniles inhabit areas in or near moderate current velocity with some amount of relatively silt free, gravel-rubble substrate. Chinook salmon juveniles are subject to predation by larger fishes such as pikeminnow, smallmouth bass, rainbow trout, and sculpins and by birds, including mergansers, terns, osprey, and belted kingfisher (Emmett et al 1991). Deeper water, surface turbulence, aquatic vegetation, instream structures and particularly, rubble substrate are important for escape cover.

Fall-run juveniles emigrate as smolts from April through June. Temperature conditions in Santa Clara Valley streams may become unsuitable for juvenile chinook salmon before June and favor smolts that emigrate earlier in the spring. In some streams, there is a small percentage of fall-run juveniles (about 5 percent) that may not emigrate until the fall or winter following hatching. Temperature conditions in Santa Clara Valley stream reaches that support chinook salmon spawning are generally too warm to support over-summer survival of chinook salmon juveniles.

Bay Checkerspot Butterfly

The bay checkerspot butterfly is federally listed as Threatened. Bay checkerspot butterflies occur on shallow, serpentine or similar soils, which support their larval food plants and nectar sources for adults. The primary larval host plant is native plantain (*Plantago erecta*). Larvae feed on the leaves of the plantain, as well as owl's clover (*Castilleja densiflorus* and *C. exserta*). Bay checkerspot butterfly populations have declined due to habitat loss caused by non-native plant species replacing native food sources, and by urban and suburban development (USFWS 1998a). The distribution of the bay checkerspot butterfly varies spatially and temporally (i.e., sites that are unoccupied one year may be occupied the next) and the number of total individuals and populations fluctuates greatly year to year (USFWS 1998a).

In Santa Clara County, areas of suitable habitat that support persistent populations are located along Coyote Ridge, immediately east of Santa Clara Valley, between San Jose and Morgan Hill. The populations are separated by discontinuities in serpentine soils and by unsuitable vegetation. However, integration between populations is expected because the two populations are within flight distance of each other (USFWS 1998a) (Figure 12: Extant Populations and Critical Habitat for the bay checkerspot butterfly in the Multi-Year Stream Maintenance Program).

Critical habitat for the bay checkerspot butterfly has been determined and includes 24,190 acres in Santa Clara County. The critical habitat is divided into units in which island-like patches of suitable habitat occur. Units 4-15 occur in Santa Clara County (USFWS 2000c) and maintenance activities are proposed in portions of Units 6, 8, 10, 12-15. Habitat protection has been identified as essential to bay checkerspot butterfly recovery, with the highest priority areas being core areas along Coyote Ridge (USFWS 1998a).

Tiburon Paintbrush

The Tiburon paintbrush is federally listed as Endangered and state listed as Threatened and is on CNPS list 1B. The species is a perennial semiparasitic herb in the figwort family (Scrophulariacea) that flowers between April and June. The Tiburon paintbrush is currently known from six occurrences in Marin, Napa, and Santa Clara Counties where it occurs in valley and foothill grasslands on serpentine substrates. In Santa Clara County the species occurs on serpentine soils west of Anderson Lake, in the Kirby Canyon area northwest of Pidgeon Point at elevations ranging from approximately 80 to 400 meters. The Tiburon paintbrush is considered threatened by development, gravel mining, and grazing (CNPS 2000). The species is protected in part at The Nature Conservancy's Ring Mountain Preserve in Marin County. The District has several facilities that overlap the southern range of the Tiburon paintbrush, such as west of Anderson Lake in the Kirby Canyon area.

Coyote Ceanothus

The coyote ceanothus is federally listed as Endangered and is on CNPS List 1B. The species is an evergreen shrub in the buckthorn family (Rhamnaceae) that flowers between January and May. Coyote ceanothus occurs on serpentine soils in chaparral and coastal scrub, and in valley and foothill grassland at elevations ranging from approximately 120 to 460 meters. This species is known from fewer that five occurrences in the foothills of the Mt. Hamilton Range and in the immediate vicinity of Anderson Dam. Coyote ceanothus is considered threatened by the expansion of the Anderson Reservoir spillway, development, and the alteration of fire regimes (CNPS 2000). The coyote ceanothus occurs on District facilities; it is known to occur near Anderson Dam, Kirby Canyon and Llagas Aveue, north of Morgan Hill.

Santa Clara Valley Dudleya

Santa Clara Valley dudleya is federally listed as Endangered and is on CNPS List 1B. The species is a perennial herb in the stonecrop family (Crassulaceae) that flowers between April and June. Santa Clara Valley dudleya grows on rocky serpentine outcrops ranging in elevation from approximately 80-335 meters. The species is known to occur in valley and foothill grassland in the Coyote Valley area, including San Jose south to San Martin and in the Almaden Quicksilver County Park area. Santa Clara Valley dudleya is considered threatened by urbanization, vehicular traffic, and grazing (CNPS 2000). The District has several facilities within the range of Santa Clara Valley dudleya in the Coyote Valley area.

Metcalf Canyon Jewelflower

Metcalf Canyon jewelflower is federally listed as Endangered and is on CNPS List 1B. The species is an annual herb in the mustard family (Brassicaceae) that flowers between April and July. Metcalf Canyon jewelflower has a limited range from San Jose south to Anderson Reservoir. It is found in valley and foothill grasslands and serpentine barrens ranging in elevation from approximately 45 to 800 meters. Metcalf Canyon jewelflower is currently known from approximately ten occurrences. The species is considered threatened by residential development, road construction, and vehicles (CNPS 2000). The District does have facilities located within the range of the Metcalf Canyon jewelflower, and there is a high probability that this species occurs on District facilities. It is known to occur adjacent to Coyote, Llagas, Upper Silver, Los Gatos and Canoas Creeks

California Sea-Blite

California sea-blite is federally listed as Endangered and is on CNPS List 1B. The species is an evergreen shrub in the goosefoot family (Chenopodiacea) that flowers between July and October. California sea-blite occurs on the margins of coastal salt marshes below approximately five meters. The species is considered threatened by recreation, erosion, and alteration of marsh habitat (CNPS 2000). Though most occurrences have been extirpated from Santa Clara County and the San Francisco Bay area in general, one possibly extant occurrence is noted in Palo Alto, which is located on a District easement. This location is not within the SMP work area.

Species of Special Concern

Mt. Hamilton Thistle

The Mount Hamilton thistle is a federal Species of Concern and is on CNPS List 1B. The species is a perennial herb in the sunflower family (Asteraceae) that flowers between February and October. Mt. Hamilton thistle is found at elevations ranging from approximately 100-890 meters. The plants grow in ultramafic seeps in valley and foothill grassland in the Hamilton Range, the Santa Teresa Hills west of Highway 101, and portions of Coyote Valley. Populations are found along the Coyote Canal and near Coyote, Alamitos, Santa Teresa, and Upper Silver Creeks. The species is considered threatened by urbanization, trampling, and grazing (CNPS 2000). The Mount Hamilton thistle occurs on District facilities in serpentine habitats in portions of Coyote Valley and the Santa Teresa Hills west of Highway 101.

EFFECTS

Saltmarsh Harvest Mouse

The range of saltmarsh harvest mice is restricted to tidal wetlands. Routine maintenance of flood conveyance channels in tidal areas are limited to a few locations. The work areas in tidal areas include very small portions of the Guadalupe River, San Tomas Aquino, Calabazas, Permanente, Stevens, Matadero, and San Francisquito Creeks, and Sunnyvale East and West Channels. None of these work areas extend into the San Francisco Bay. A total of 29 acres of tidal wetlands are expected to be affected by sediment removal and 1 acre of tidal wetlands are expected to be affected by vegetation management activities. Although these activities are proposed in tidal areas, the SMP work area does not include areas that contain suitable habitat for saltmarsh harvest mice.

Saltmarsh harvest mice are not expected to occur in the stream channel from where sediment is removed. Removal of vegetation from the channel for flood conveyance does not include removal of pickleweed (*Salicornia* spp.), cordgrass (*Spartina* spp.) or other halophytic species that characterize the higher intertidal zone where saltmarsh harvest mice are typically found. Saltmarsh harvest mice are not expected on stream banks that will receive bank protection because these are typically unvegetated due to soil erosion. Road grading, trash removal, and other minor stream maintenance activities are not expected to occur in salt or tidal wetlands and therefore, are not expected to affect saltmarsh harvest mice. To ensure that saltmarsh harvest mice do not come into contact with poisoned grain set out to control burrowing rodents that may damage levees (a minor maintenance activity), lethal control methods will not be used in the potential range of saltmarsh harvest mice (BMP 3.21). The District considers potential saltmarsh habitat to include areas north of Highway 237 (Figure 6). Saltmarsh harvest mouse habitat maps will be refined as surveys are conducted. Further guidelines for minimizing impact on non-target species from rodenticides are provided in BMP 3.21.

To ensure that work areas are not within suitable saltmarsh harvest mouse habitat, areas that may contain suitable habitat will be surveyed prior to any maintenance activity, and impact avoidance measures, including buffer zones, will be implemented as necessary to avoid impacts to any potentially occupied saltmarsh harvest mouse habitat (BMPs 3.1 and 3.2). Long-term monitoring of populations and mapping of suitable habitat will occur to identify potential habitat and to avoid future impacts (BMP 3.19).

Western Snowy Plover

Western snowy plovers may use salt pans and levees adjacent to salt ponds in southern San Francisco Bay. Sediment removal and vegetation management activities will not occur in suitable nesting habitat for this species. In addition, bank protection is not expected to occur in areas potentially used by western snowy plovers. However, sediment removal may occur in areas adjacent to where snowy plovers nest and minor activities, such as levee and road grading, may occur in the vicinity of plover nesting habitat. Impacts to western snowy plovers will be avoided by conducting surveys during the breeding season in areas that contain suitable nesting habitat and implementing avoidance measures, including buffer zones, as necessary (BMPs 3.1 and 3.2). Long-term monitoring of populations and distribution of snowy plovers in southern San Francisco Bay will occur to identify sensitive sites (i.e., plover nests) and to avoid future impacts (BMP 3.19).

California Clapper Rail

California clapper rails are found in tidally influenced areas. Routine maintenance of flood conveyance channels in tidal wetlands are limited to very few locations. The District has developed a range map indicating the distribution and the breeding habitat of California clapper rails (Figure 8). This range map was overlaid with the projected SMP work areas to determine areas of overlap. The range of the clapper rail includes tidal sloughs from San Francisco Bay upstream to the first bridge and includes most salt evaporator ponds. Salt evaporator pond A4 was excluded from the range of the clapper rails based on the results of intensive survey work at Pond A4 and at Sunnyvale East Channel over the last 4 years. On San Francisquito Creek the range extends approximately 1000 ft upstream of the pedestrian bridge to a point where the habitat no longer appears suitable.

The SMP work areas do not include any areas that contain dense vegetation that is considered suitable nesting habitat for clapper rails, but the work areas may include suitable foraging habitat. Because clapper rails may forage within the stream channel, sediment removal or vegetation management could disrupt foraging individuals or destroy foraging habitat. Bank protection could also eliminate foraging habitat. Based on the habitat range map described above and the overlap with the projected SMP work areas, the District anticipates approximately 11.0 acres of potential California clapper rail habitat may be affected (Table 7).

Road grading, trash removal, and most other minor stream maintenance activities are not expected to affect clapper rails because these activities are not expected to occur in salt or tidal wetlands. Rodent control is not expected to affect clapper rails because poisoned grain will not be set out in saltmarsh habitat due to potential effects on saltmarsh harvest mice and because clapper rails do not typically consume grain (BMP 3.21)

To avoid effects to breeding California clapper rails in channel, maintenance activities will be conducted at least 500 ft. away from suitable breeding habitat unless conducted between September 1 and January 31. In areas where the District intends to work in-channel and clapper rails are suspected to occur (potential foraging habitat) the District will conduct pre-construction surveys. These surveys will be conducted by a qualified biologist to determine if clapper rails are present. The surveys will also be used to flush any clapper rails out of the work sites. In areas where sediment removal activities are to occur, the surveys will be conducted on a daily basis while the project is underway.

The District recognizes that temporary displacement of foraging clapper rails and disturbance of foraging habitat will constitute take. General surveys to identify the distribution of clapper rails will follow the District's existing Section 10(a)(1)(A) permit protocol but will incorporate other USFWS requirements provided in the Incidental Take Statement.

The District is proposing to compensate for the temporary and permanent habitat loss by restoration of 30 acres of tidal marsh habitat. More information about the restoration of the diked salt evaporation pond (Pond A4) to tidal marsh is given in the Compensatory Mitigation section below.

Least Bell's Vireo

Historically, least Bell's vireos were common in dense riparian areas in Santa Clara County; however, they were thought to be extirpated from the County in the 1980's (USFWS 1994). In 1997, a nesting pair was observed in the lower Llagas Creek area in Santa Clara County and least Bell's vireos have recently been sighted in this same area. Llagas Creek, downstream of Highway 152 to the confluence with the Pajaro River and the Pajaro River within Santa Clara County, has not been regularly maintained as provided for in the original flood protection project design. During that period, the riparian vegetation has developed. Removal of existing riparian vegetation from this location has the potential for environmental effects not within the scope of the SMP. Maintenance work within the channel in this section of Llagas Creek and the Pajaro River are not considered routine until the status of least Bell's vireo at this location is determined and a plan for future maintenance is developed. At that time, future routine maintenance will be evaluated under a new or revised CEQA evaluation.

The District evaluated habitat conditions for least Bell's vireo in 2000 and identified one additional site that may support least Bell's vireos. This site was located on West Little Llagas Creek upstream of Monterey Road. In August 2001 this evaluation was conducted (Table 8, Figure 9). This evaluation looked at habitat in the Llagas and Uvas watershed and found potential habitat sites for least Bell's vireo. The District will continue to monitor these potential habitat sites through BMP 3.19. If these sites become occupied by least Bell's vireos, then the sites will drop out of the SMP. Work areas west of U.S. 101 are outside the historic range of the least Bell's vireo (USFWS 1998).

Under the SMP, no sediment removal, wetland vegetation control, or removal of in-channel trees will occur and no riparian vegetation will be affected in the areas identified above as potential vireo habitat. However, some vegetation management will occur, such as herbicide use in upland areas and along levee slopes, maintenance roads and fire breaks, and control of giant reed on the Pajaro River. The only proposed work area overlapping potential vireo habitat is on Llagas Creek west of the San Martin Airport. This section of creek has heavy growth of giant reed. If the District designates this location as part of the giant reed control program, the removal of giant reed would be by mechanical devices with subsequent treatment by herbicides. If least Bell's vireo is found during in-channel surveys, no work will be conducted at that location. The District plans a significant effort to enhance riparian habitats throughout the county through exotic species control and restoration, in addition to riparian revegetation accompanying bank protection (for more information see SMP, Appendix J, and Attachment C in this BA). These efforts can be expected to benefit many riparian species as well as improving habitat for least Bell's vireos. The District will implement monitoring of riparian revegetation efforts for their use by bird species and to identify sensitive sites and to avoid future impacts to least Bell's vireos (BMP 3.19). Other sections of Llagas Creek upstream of Watsonville Road are shown as projected work areas in Figure 9. Work on this section of creek is only conducted at bridge crossings and will not affect the vireo habitat. These maintenance activities have been conducted over many years and will not have no new effects on the ecology and hydrology of the Pajaro River Basin.

San Francisco Garter Snake

The four recorded occurrences of San Francisco garter snake in Santa Clara County are historical records (i.e., at least 20 years old), from museum collections and published references. These reported occurrences of San Francisco garter snake in Santa Clara County are from the extreme northwestern portion of the county. There have been no recent records of San Francisco Garter Snakes in Santa Clara County. Current populations are known to exist only in San Mateo and Santa Cruz Counties (Biosystems 1994). These four locations are not within the action area and there are barriers between these locations and the action area. There is no affect on San Francisco garter snake from the Stream Maintenance Program.

California Red-legged Frog

California red-legged frogs are found in freshwater habitats and adjacent riparian and upland vegetation throughout the year. California red-legged frogs are well distributed in the foothills and mountains of Santa Clara County; however, much of the District's activities would occur in the valley bottom where the species is no longer found. The likelihood of California red-legged frogs being present in the valley bottom, which is highly urbanized, is reduced because the habitat requirements of the California red-legged frog are typically not compatible with the urban stream environment. During the winter months, high stream flows force the frogs out of the creeks and into the surrounding landscape to seek refuge. The successful movement of frogs across this urban landscape is improbable. The Service acknowledged this problem in its delineation of critical habitat when it described the hazards of heavily traveled roads to California red-legged frogs (USFWS 2001).

The USFWS (2000a) included much of Santa Clara County in the South and East San Francisco Bay and the Diablo Range and Salinas Valley recovery units for the California red-legged frogs. Within these recovery units, core areas were described as where recovery actions will be focused. Because many areas within each recovery unit are expected to remain unsuitable (e.g., areas of heavy agricultural use, urban and suburban areas), USFWS recognizes that focusing initially in core areas will encourage implementation of efforts that are most likely to contribute to recovery. The District does not propose any maintenance activities in the core areas. The District's action area for the SMP is the valley and lower foothill portion of the county where urban, suburban, and heavy agricultural uses occur and where habitats are generally unsuitable for California red-legged frogs.

Although the most of the action area for the SMP is not generally considered high quality habitat for California red-legged frogs, individuals have been recorded in or near work areas. Although some of these work areas are within 1 mile of known frog sites, they may or may not be expected to have an adverse effect on the population or individuals. Table 9 describes the potential for impact for each population location. A total of 29.3 acres of red-legged frog habitat may be affected by the SMP.

Sediment removal activities could result in the loss of individuals through direct mortality during the extraction of sediment from the stream channel. In-channel vegetation management could also result in direct mortality and could remove vegetation required for feeding, breeding, and sheltering. Vegetation management should not result in substantial release of additional sediment in downstream areas because in most cases the SMP is a continuation of existing practices and occurs in areas where sediment removal and vegetation management have occurred previously. Bank protection could negatively impact California red-legged frogs through loss of habitat over time by precluding the re-establishment of riparian vegetation. Using hardscape methods to stabilize banks would prohibit re-establishment of riparian vegetation and would eliminate foraging habitat and escape cover. Minor activities, such as minor sediment removal at and cleaning of flood protection appurtenant structures and removal of downed trees from streams, could adversely affect red-legged frogs through injury or destruction of individuals or egg masses.

To avoid and minimize impacts to California red-legged frogs, the District is implementing several BMPs. To avoid injury or destruction of individuals or egg masses, suitable habitat will be surveyed and avoidance measures will be implemented prior to the start of sediment removal projects (BMPs 3.1). Areas of known occurrences will be listed in the District's GIS database, which will assist in planning activities. Populations throughout the work area will be monitored through the establishment of a biodiversity monitoring program (BMP

3.19), which will assist in avoiding future impacts. Project-specific resource protection measures, such as set-backs or buffer zones, will be employed to the maximum extent practical to minimize impacts to occupied habitat. If individuals are found in the work area, they will be moved by a qualified biologist to suitable habitat outside of the project limits and in accordance with guidance and permit requirements from USFWS and CDFG (BMP 3.1, 3.7).

Additional BMPs are provided to minimize adverse affects from specific maintenance activities. Instream work will be performed when low or no flows are present in channels (BMP 1.1). Restoring the pool configuration of the channel bottom (BMP 3.15) after sediment removal will minimize permanent habitat alteration. Avoiding dewatering all of an isolated reach of a creek (BMP 3.11) and removing sediment from one side of the channel in alternate years (BMP 3.6) will reduce the likelihood that individuals will be injured or destroyed by sediment removal activities.

The amount of vegetation removed in work areas will be minimized (BMP 2.1). Biotechnical bank protection projects, which include soft structures, such as planting native riparian vegetation, will be utilized when feasible (BMPs 1.5, 2.3, 2.5, 2.6, and 2.7). The biotechical stream bank protection methods for fish also apply in part to California red-legged frogs. For example, frogs may use instream wood above the water as resting sites. Bank protection using rock has some value as cover and resting sites. Habitat enhancement for red-legged frogs will occur as a result of planting vegetation as part of pro-active bank protection (BMPs 2.5 and 2.7) and maintenance of stable undercut banks (BMP 3.14).

Although the District is implementing methods to avoid and minimize adverse affects on California red-legged frogs, the District recognizes that some direct mortality may be unavoidable due to the difficulty surveying aquatic habitat and the mobility of red-legged frogs. Direct mortality, re-locating individuals from the work site to other suitable habitat, and alteration of red-legged frog habitat will constitute take. The District is requesting authorization for take and is proposing to compensate for the temporary and permanent habitat loss by acquisition and protection of habitat at offsite locations. See the Compensatory Mitigation section below for more details.

California Tiger Salamander

Because California tiger salamanders require breeding pools that are free of predatory fish, they are not expected to occur within most streams and channels in the SMP work area, which are flowing waterways that support a variety of fishes. However, California tiger salamanders are recorded near some work areas in ephemeral pools or upland habitats, as shown in Figure 11.

Bank stabilization is not expected to have an adverse affect on tiger salamanders because they are not expected to occur on eroding banks with stream channels that are subject to high velocity water flows that require stabilization. Control of rodents is also not expected to have a direct adverse affect on tiger salamanders because they are not expected to consume poisoned grain. Because the area of overlap between the SMP work area and suitable tiger salamander habitat is minimal, the reduction in number of rodent burrows due to the SMP is expected to be negligible.

The District reviewed all work activities within the potential habitat of tiger salamanders and within 1 mile of known tiger salamander occurrences. Many of these areas do not support tiger salamanders and are in the urban environment. There are barriers between the salamander and work locations. In other cases the type of work or timing of work lead to an affect conclusion (Table 10).

In areas that contain potential California tiger salamander habitat, pre-construction surveys will be conducted to ensure that salamanders are not present in the work area (BMP 3.1). If California tiger salamanders are found in the work area and can be avoided, their locations will be mapped by qualified personnel and the areas will be avoided with an appropriate setback (BMP 3.1) or alternative methods will be employed to meet the same objective. If tiger salamanders cannot be avoided in the work area, they will be moved to appropriate habitat outside of the work area by qualified personnel, and in accordance with applicable USFWS and CDFG regulations.

The District may affect California tiger salamanders by conducting preconstruction surveys (BMP 3.1) for baseline distribution and abundance surveys (BMP 3.19). These impacts from surveys require no mitigation.

Steelhead

Streams within the Santa Clara Valley are within the critical habitat designation of Central California Coast steelhead and streams within the Pajaro River watershed are within the critical habitat designation of South-Central California Coast steelhead. Critical habitat is the specific areas within the geographical area occupied by the species where those physical and biological features essential to the conservation of the species are located. In both the Santa Clara Valley and Pajaro River watershed, critical habitat includes stream reaches used by steelhead (both adults and smolts) for migration between the ocean and upstream spawning and rearing habitat, and stream reaches used for spawning and juvenile rearing.

Reaches supporting steelhead spawning and rearing occur primarily at the valley margins and in accessible headwater areas while sediment removal occurs primarily in urbanized areas of the valley floor (Figure 4). Sediment removal activities are projected to occur on only 0.1 miles of stream supporting steelhead spawning and rearing habitat in the Santa Clara Basin and are not projected to occur at all in stream reaches supporting steelhead spawning or rearing in the Pajaro River Basin (Table 11, Figure 4). Sediment removal activities are projected to occur primarily in reaches supporting steelhead migration. Proposed BMPs (as described below) are expected to protect steelhead in reaches where sediment removal will occur.

Steelhead adults migrate upstream during the winter (December through April), typically during higher flow periods. Migrating adults need unobstructed passage, relatively cool temperatures, and other water quality parameters within suitable ranges. Steelhead smolts migrate downstream in the spring, typically from March through June with a peak in April. Although sediment removal may occur throughout the year, sediment removal projects in streams where there are or could be salmonids present will be implemented outside of the migrating and spawning season which is considered to last from October 15 to June 15. District procedures preclude stream maintenance activities during periods when special-status species may be present in the area (BMPs 3.1, 3.7, and 3.10). Long-term monitoring of populations and distribution will occur to identify sensitive sites and to avoid future impacts to salmonids (BMP 3.19).

In addition, the District's Dryback/Fish Relocation Operation Guidelines (included in this BA as Attachment F) have provisions for fish passage or transport when maintenance operations during potential migration periods cannot be avoided.

Several District BMPs have provisions that minimize potential impact on steelhead migration routes. The District will regrade the channel bottom at the end of the work project to as close to original conditions as possible (BMPs 3.12 and 3.15). This would include replication of a low flow channel within the finished topography.

There are also provisions in District BMPs to avoid impacts related to the few sediment removal projects that may occur within stream areas supporting steelhead spawning or rearing. These include temporary dewatering of worksites and relocation of fish to substitute habitat (BMPs 1.3, 3.10, and 3.11); minimizing mobilization of fine sediments (BMP 1.4); retention of woody debris where possible (BMP 3.9); restoration of pool configuration (BMP 3.15); restoration of spawning gravels (BMP 3.16); and protection of water quality (BMPs 4.5, 6.1, 6.4, and 6.5).

Most sediment removal projects involve removal of fine sediments from engineered channels. Most of the sediment removed is in areas downstream of habitat used for spawning by steelhead. Removal of fine sediments can be beneficial in reaches supporting salmonid spawning since fine sediments in riffle-run areas can adversely affect embryo survival, food production, and juvenile escape cover. If sediment removal occurs in salmonid spawning habitat, District BMPs are implemented to minimize or avoid impacts. Pool configuration is restored (BMP 3.15), and spawning gravels are replaced (BMP 3.16).

Vegetation management activities within steelhead critical habitat are projected to occur primarily within reaches supporting steelhead migration and not in spawning and rearing reaches (Table 11). The majority of vegetation management activities (approximately 75 percent on an acreage basis) occurs outside of the area of inundation, is on flat areas, and generally has a buffer of grass or vegetation on the slopes between the right-of-way and the stream. These upland activities are not expected to impact habitat for steelhead.

The remaining vegetation management activities occur on approximately 1000 acres on an annual basis (about 25 percent of all vegetation management by acreage) and involve in-stream removal using aquatic herbicide application or mechanical removal. This activity is most common in modified channels in the lower gradient, more urbanized stream reaches used by steelhead primarily as migration corridors. Removal of vegetation in these channels does not affect the ability of adult salmonids to migrate through them but may remove cover useful for migrating juveniles or smolt if large areas are cleared. This effect could be reduced by minimizing vegetation removal on job sites (BMP 2.1).

Target vegetation consists mainly of tall emergent wetland vegetation such as cattails and bulrush, or woody vegetation consisting of native riparian species such as willows and box elder and non-native eucalyptus. Aquatic environments supporting extensive growth or cattail or bulrush are generally associated with shallow, open channels and warm temperatures and are not usually characteristic of steelhead rearing habitat. Woody riparian vegetation that is targeted is younger growth generally 3 feet tall or less and rarely exceeding 10 feet in height. Although removal of young woody vegetation prevents establishment of SRA habitat potentially important to rearing steelhead, this activity is generally confined to low gradient, valley floor reaches that do not support steelhead rearing. Vegetation management is the continuation of existing practices and therefore does not change the baseline conditions.

Herbicide use in in-stream areas is limited to formulations approved for aquatic use and District policy is to use herbicides in a way that avoids or minimizes environmental effects (BMPs 1.14, 3.18, and 3.20). Herbicides are used in a manner consistent with EPA Use Limitation Codes for aquatic animals as discussed above (Table 1).

Large amounts of decaying vegetation left in the stream may cause deterioration of water quality through depletion of oxygen. This would be a transient effect and adverse effects to steelhead migration could be avoided by timing the activity to occur after June when smolts have finished emigration (BMP 3.10).

Bank protection activities within steelhead critical habitat may occur in reaches supporting steelhead migration and in reaches supporting spawning and rearing. As described more fully in the Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities (included as Attachment C in this BA) , streams supporting steelhead or resident trout spawning and rearing are recognized as highly sensitive and only bank protection methods incorporating fishery values that fully protect and enhance habitat quality for steelhead would be permitted under the SMP. Projects deviating from these requirements would not be covered under the SMP long-term guidance and would be reviewed separately on a case-by-case basis.

Impacts of bank protection to steelhead and chinook salmon depend on the fish community supported in the reach where a bank protection project is located, the fishery values present at the site, and the type of bank protection installed. Fish communities present in District managed streams may range from cold water streams supporting steelhead or resident rainbow trout to highly modified channels with intermittent flows and no value to fish (Figure 4). Bank protection projects installed in steelhead rearing habitat have a great potential for impact, while those installed in modified channels with no fish value have little potential for impact to salmonids.

Even within stream reaches supporting rearing steelhead, there may be a range of fishery values at any given site requiring bank protection. Important fishery values include:

- Shading and food production provided by mature riparian shrubs and trees;
- Instream escape cover provided by undercut banks, large boulders, tree roots, downed trees, and other structural elements (including deteriorating bank protection projects);
- Overhanging escape cover provided by shrubs and grasses near the stream edge;
- Hydraulic complexity resulting from the interaction of the current with the same structural elements providing instream escape cover;
- Velocity refuge also provided by structural elements, and;
- Stabilization of fine sediments provided by riparian shrubs and grasses.

Some types of bank protection can provide some of these same fishery values while other types do not. Bank protection projects that incorporate fishery values in their design can be used even in the most sensitive stream types. If bank protection projects incorporating fishery values are used in sensitive stream types at locations where those values were not previously present, the bank protection may actually enhance fishery values. Attachment C provides information on different bank protection techniques which limit or do not limit biotic potential. In addition to functions and values noted in the table, all methods provide fine sediment stabilization.

It is not always possible for the District to use bank protection methods incorporating the highest fishery values due to constraints such as cost, available right-of-way, bank slope and other site features. The District thus proposes to implement the Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities program, which avoids potential impacts to the greatest extent possible and incorporates mitigation to balance impacts that cannot be avoided. Key elements of this program are summarized below and described in full in the Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities (Attachment C of this document).

The bank protection program avoids impacts by distinguishing three categories of streams based on the fishery values they support (Figure 4) and altering bank protection methods accordingly. First, streams supporting or potentially supporting steelhead and resident trout are recognized as highly sensitive and bank protection methods that do not incorporate fishery values are not acceptable in these streams (Fish Habitat Categories are described in the document on pp. 28-32). Only bank protection methods incorporating fishery values that, at a minimum, replace those previously present will be used. If a site requiring bank protection is located in this type of stream but has limited or no fishery values present, methods incorporating fishery values would be counted as mitigation credit at a 1:1 ratio for other bank protection program impacts. If site constraints are such that methods incorporating fishery values cannot be used, the project will not be covered in the SMP environmental review and permits, and agencies will be consulted on a case-by-case basis.

A second category of stream reaches does not support steelhead or resident trout but occurs downstream of steelhead/trout habitat and may therefore be used by migrating individuals. In addition, chinook salmon may spawn in some of these reaches and salmon fry may rear there for brief periods in the spring. Alternatively these reaches may be dominated by a natural assemblage of native warmwater fish (primarily Sacramento sucker and California roach) and may also have the potential to support red-legged frogs and other sensitive species. Although not as critical as the first group of streams, fishery values including escape cover, velocity refuge, and fine sediment stabilization may still be important. In this group of stream reaches, bank protection projects will use methods incorporating fishery values at sites where those values are present. Methods that do not incorporate fishery values may be used but must be mitigated on a 1:1 or 3:1 basis (see below). If bank protection sites do not support fishery values, using methods that support such values will gain mitigation credits on a 1:1 basis while use of other methods will result in neither loss or gain of mitigation credits.

The third category of stream reaches has no steelhead or trout habitat upstream but may itself support a variety of fish community types, including mixed native and introduced, fish scarce, and no value. In such streams, bank protection projects incorporating fishery values may have little benefit to the aquatic community present. Greater flexibility in selection of bank protection methods is possible in this category and, while other species should be considered, virtually any method may be selected without potential impact to steelhead/rainbow trout, chinook salmon, or fish communities dominated by warmwater native fish (although other biological impacts to non-salmonids may occur).

To further reduce the adverse effects of bank protection, the District will mitigate for all impacts for impervious hardscape and for unvegetated rock bank protection at a ratio of 3:1 by area and for all vegetated rock at a ratio of 1:1 by area regardless of the determination of the impact assessment matrix.

Most minor stream maintenance activities will not affect steelhead or their habitat. However, removal of downed trees has the potential to affect these species since downed trees can provide habitat in the form of escape cover, and they also induce hydraulic complexity that can form pools, create important foraging habitat, and provide medium-high velocity refugia and resting cover for migrants. Downed trees also represent a source of nutrient inputs to the aquatic environment and are colonized by aquatic growths and associated organisms in complex associations that may ultimately provide forage for rearing salmonids.

District policy limits removal of trees and other woody material to situations where it is threatening a structure or results in flood capacity deficiencies (BMP 3.9). In stream reaches supporting steelhead rearing, the District will use the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998) to determine when and how woody material should be removed under the guidance of District fisheries staff. The District may affect steelhead by implementing the Stream Maintenance Program. These effects are fully mitigated by implementation of BMPs and the programmatic impact assessment and mitigation for bank protection activities.

Chinook Salmon

Sediment removal is projected to occur in reaches used by migrating chinook salmon as adults and smolts and may occur in some reaches used by chinook salmon for spawning. Chinook salmon migrate into Coyote Creek and the Guadalupe River as early as August and spawn through December. Migrating adults need unobstructed passage, relatively cool temperatures, and other water quality parameters within suitable ranges. Chinook migrate downstream as fry beginning as early as March and as smolts through late May. Although sediment removal may occur throughout the year, sediment removal projects in streams where there are or could be salmonids present will be implemented outside of the migrating and spawning season which is considered to extend from October 15 to June 15. District procedures precludes stream maintenance activities during periods when special-status species may be present in the area (BMPs 3.1, 3.7, and 3.10). Long-term monitoring of populations and distribution will occur to identify sensitive sites and to avoid future impacts to salmonids (BMP 3.19).

As described for steelhead, the District's Dryback/Fish Relocation Operation Guidelines (Attachment F) has provisions for fish passage or transport when maintenance operations during potential migration periods cannot be avoided (e.g., during late summer when chinook salmon adults may migrate upstream). There are also several District BMPs that minimize potential impact on chinook salmon migration routes including regrading of the channel bottom at the end of the work project and replication of a low flow channel within the finished topography (BMPs 3.12 and 3.15).

There are provisions in District BMPs to avoid impacts related to the few sediment removal projects that may occur within stream areas supporting chinook salmon spawning or rearing. These include temporary dewatering of worksites and relocation of fish to substitute habitat (BMPs 1.3, 3.10, and 3.11); minimizing mobilization of fine sediments (BMP 1.4); retention of woody debris where possible (BMP 3.9); restoration of pool configuration (BMP 3.15); restoration of spawning gravels (BMP 3.16); and protection of water quality (BMPs 4.5, 6.1, 6.4, and 6.5).

Most sediment removal projects involve removal of fine sediments from engineered channels. Most of the sediment removed is in areas downstream of habitat used for spawning by chinook salmon. Removal of fine sediments can be beneficial in reaches supporting salmonid spawning since fine sediments in riffle-run areas can adversely affect embryo survival, food production, and juvenile escape cover. If sediment removal occurs in salmonid spawning habitat, District BMPs are implemented to minimize or avoid impacts. Pool configurations are restored (BMP 3.15), and spawning gravels are replaced (BMP 3.16).

As described for steelhead, the majority of vegetation management activities occurs outside of the area of inundation and are not expected to impact habitat for chinook salmon. The remaining vegetation management activities involve in-stream removal using aquatic herbicide application or mechanical removal, predominantly in modified channels in the lower gradient, more urbanized stream reaches used by chinook salmon primarily as migration corridors. Removal of vegetation in these channels does not affect the ability of adult salmonids to migrate through them but may remove cover useful for migrating juveniles or smolts and prevent establishment of SRA habitat if large areas are cleared. This effect could be reduced by minimizing vegetation removal on job sites (BMP 2.1) and is continuation of existing practices and therefore does not change the baseline conditions.

Herbicide use in in-stream areas is limited to formulations approved for aquatic use and District policy is to use herbicides in a way that avoids or minimizes environmental effects (BMPs 1.14, 3.18, and 3.20). Herbicides are used in a manner consistent with EPA Use Limitation Codes for aquatic animals as discussed above (Table 1). Although large amounts of decaying vegetation left in the stream may cause deterioration of water quality through depletion of oxygen, this would be a transient effect and could be avoided by timing the activity to occur in chinook salmon spawning reaches after June when smolts have finished emigration (BMP 3.10).

Impacts of bank protection to chinook salmon would be similar to those described for steelhead except that chinook salmon rear for only a brief period in the spring before emigrating to the marine environment and are not as dependant on stream rearing habitat as steelhead. The bank protection program, described in the Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities (Attachment C), treats reaches used by chinook salmon for rearing, spawning, or migration as moderately sensitive and prescribes bank protection methods that do not reduce or eliminate those functions.

Most minor stream maintenance activities will not affect chinook salmon or their habitat. However, removal of downed trees has the potential to affect these species since downed trees can provide habitat in the form of escape cover, and they also induce hydraulic complexity that can form pools, create important foraging habitat, and provide medium-high velocity refugia and resting cover for migrants. Downed trees also represent a source of nutrient inputs to the aquatic environment and are colonized by aquatic growths and associated organisms in complex associations that may ultimately provide forage for rearing salmonids. District policy limits removal of trees and other woody material to situations where it is threatening a structure or results in flood capacity deficiencies (BMP 3.9). The District may affect chinook salmon by implementing the Stream Maintenance Program. These effects are fully mitigated by implementation of BMPs and the programmatic impact assessment and mitigation for bank protection.

Bay Checkerspot Butterfly

Bay checkerspot butterflies are associated with serpentine habitats and may be found adjacent to stream channels and water delivery canals where stream maintenance activities are planned. The District has a number of facilities which border or are contained within bay checkerspot butterfly Critical Habitat. These include areas on Canoas Creek, Silver

Creek, Almaden-Calero Canal, Coyote-Alamitos Canal, Coyote Canal and Coyote Canal Extension. Each of these areas are described in more detail below.

Canoas Creek

Canoas Creek borders the Communications Hill Unit (Unit 6) of designated Critical Habitat but is not within the unit. A few small serpentine outcrops are located along the creek but outside the critical habitat designation. Canoas Creek in the vicinity of the Communications Hill Unit is bordered by urban development, including trailer parks and homes. Most of the creek is bordered by urban landscaping and woodlands. Work in this area would not affect critical habitat or the bay checkerspot butterfly because the work area does not contain suitable habitat and checkerspot butterflies are not likely to be present.

Silver Creek

Upper Silver Creek borders the Silver Creek Unit (Unit 12) of designated Critical Habitat but is not within the unit. Silver Creek is bordered by dense stands of coast live oak and in some cases willows. Upslope from the creek (between the creek and the Silver Creek Unit) is a bicycle/pedestrian path. The creek does cross several patches of serpentine habitat. Upstream of U.S. Highway 101, the creek crosses a patch of serpentine soils; however this section of the creek is contained within a concrete trapezoidal channel. Upstream on Upper Silver Creek between Silver Creek Road and Silver Creek Valley Road, the creek crosses through a couple of patches of serpentine soil. This section of the creek is a unmodified channel with riparian vegetation along the banks and is unsuitable habitat for the bay checkerspot butterfly. Because this creek is located in the urban environment, is vegetated with shrubs and trees, and is located outside of critical habitat, the bay checkerspot butterfly is unlikely to be present.

Almaden-Calero Canal

The District has four canals which border or pass through critical habitat or serpentine habitat areas. Each of the canals has an access road which borders the canal and is maintained as part of the SMP. The Almaden-Calero Canal extends from Almaden Reservoir to Calero Reservoir. Most of the canal is located outside of the bay checkerspot Critical Habitat (San Vicent-Calero Unit [Unit 13]). These areas are primarily heavy brush, chaparral and woodland areas west of Chilanian Gulch. East of Chilanian Gulch the canal forms the northern boundary of the San Vicente-Calero Unit. This area is a patchwork of grassland, coastal sage scrub, and oak woodland. Work in this area is not likely to affect critical habitat or the bay checkerspot butterfly because the work area does not contain suitable habitat and checkerspot butterflies are not likely to be present.

Coyote-Alamitos Canal

The Coyote-Alamitos Canal traverses the northern flank of the Santa Teresa Hills. The Santa Teresa Hills Unit (Unit 14) is located upslope from the canal west of Cottle Road. The canal crosses through the northern edge of the Santa Teresa Hills Unit east of Cottle Road. Much of the western portion of the canal is located in a coast live oak - California buckeye woodland. Grasslands are present along a few areas on the central and eastern portion of the canal. Serpentine soils are located along the canal in the vicinity of Cottle Road. The District owns several parcels along the Coyote-Alamitos Canal where vegetation control is undertaken for fire prevention. Where possible on these parcels, perimeter mowing is performed to create defensible space between the urban areas downslope and the undeveloped areas upslope. These areas are primarily vegetated with annual grasses and herbacrous plants such as black mustard (*Brassia nigra*).

The far eastern portion of the Coyote-Alamitos canal skirts the northern edge of Tulare Hill Unit (Unit 15). The canal traverses grassland habitats with large populations of the butterfly host plant. The District has several upland parcels in this area where annual vegetation is mowed to create defensible space between the urban areas downslope and the wildland areas upslope. Routine maintenance activities such as mowing upland vegetation may affect bay checkerspot butterflies in this area.

Coyote Canal

The Coyote Canal follows the base of Coyote Ridge and diverts water around Coyote Valley in compliance with a legal settlement dating back to the 1930s. The Coyote Canal is crossed by U.S. Highway 101 at three locations. Potions of the canal upslope of U.S. 101 are located in the Kirby Unit (Unit 8) of critical habitat. Upstream of the first U.S. 101 crossing, the canal traverses areas dominated by tree, shrub and grassland habitats. No portion of the canal or access road in this area cross through serpentine soils.

Downslope of U.S. 101 the canal is located outside of critical habitat and in part passes through the Coyote and Riverside Golf Courses. There is no serpentine soil located along this portion of the canal.

Downstream of the second U.S. 101 crossing, the canal passes through an oak-sycamore woodland before traversing open grassland. None of these areas are found in serpentine soils. West of the County's Sportsman's Park, the canal again crosses U.S. 101 and connects to Coyote Creek. This area is a sycamore woodland and is not within critical habitat.

Work in the Coyote Canal area would only be conducted when butterflies are inactive and would not affect serpentine habitats or the bay checkerspot butterfly.

Coyote Canal Extension

The Coyote Canal Extension follows the base of Coyote Ridge north from the end of the Coyote Canal to the Evergreen Pump Station north of Silver Creek Valley Road. This canal is no longer used for water transport and portions of the canal have been abandoned. The canal is used as a drainage ditch during the winter months. The Coyote Canal Extension is located in the Kirby Unit (Unit 8) and the Metcalf Unit (Unit 10) of critical habitat. The canal traverses serpentine grasslands and sage scrub habitats and maintenance work in this area may affect bay checkerspot butterflies or their host plants.

Avoidance and Minimization Measures

The District uses a variety of methods to avoid herbicide application of non-target species. These methods are described in the Vegetation Management Project Description section above. In addition, the District is committed to avoiding destruction of serpentine habitats (BMP 3.3). Project-specific resource protection measures, such as set-backs or buffer zones, will be used to avoid impacts to bay checkerspot butterflies or their host plants (BMP 3.1). Long-term monitoring of populations and distribution of bay checkerspot butterflies will occur to identify sensitive sites and to avoid future impacts (BMP 3.19).

To further avoid and minimize any impacts to bay checkerspot butterflies and their host plants, the District proposes the following restrictions along its canals. Based on the bay checkerspot butterfly's avoidance of heavy brush and trees (USFWS 2001), most woodland and chaparral areas are not be considered habitat for the bay checkerspot butterfly. The District would continue to maintain the Coyote-Alamitos canal as an access road in these areas using methods it considers appropriate (herbicide, hand, mechanical). In grassland areas where host plants or bay checkerspot butterflies are known to occur (based on surveys) the District would exclude the use of herbicides and would limit the use of mechanical or hand work to the period after June 1. Areas of grassland habitat where spraying will not be permitted will be permanently marked with signs, and the District's GIS system for sensitive species will list these areas (BMP 3.3).

Tiburon Paintbrush, Coyote Ceanothus, Santa Clara Dudlyea, Metcalf Canyon Jewelflower and Mt. Hamilton Thistle

Because Tiburon paintbrush, coyote ceanothus, Santa Clara dudlyea, Metcalf Canyon jewelflower, and Mt. Hamilton thistle occur in similar serpentine habitats, potential effects on them are discussed together.

Because most stream maintenance activities occur within the stream channels and the serpentine-associated plants listed above occur in upland habitats, sediment removal, in-stream vegetation management, and bank protection are not expected to have direct effects on populations of special-status plants occurring within the action area, with the exception of Mt. Hamilton thistle, which may occur in wetland areas. Clearing or spraying of vegetation in upland and riparian areas adjacent to streams could affect populations of upland plants. In addition, some minor activities, such as road grading may affect upland plants. Mt. Hamilton thistle, which is known to occur on an alluvial fan draining into the Coyote Canal, may be affected by in-stream maintenance activities, as well as upland vegetation management.

The District uses a variety of methods to avoid herbicide application of non-target species. These methods are described in the Vegetation Management Project Description section above. Impacts resulting from the operation of maintenance equipment in upland areas adjacent to channels will be avoided to the extent practical. Work areas that have the potential to support special-status plant species will be surveyed prior to maintenance activities (BMP 3.1). Buffer zones will be established around populations of special-status plants in the work area and no maintenance activities will be conducted within these buffer zones, to the extend feasible. If other vegetation (non-sensitive plants) is to be removed within the buffer zone, it will be done by hand removal or hand spraying and these activities will only be permissible when performed by qualified District staff able to identify, and thus avoid, special-status plants (BMP 3.1). Buffer zones will also ensure that populations are not inadvertently affected by drift of herbicides or by vegetation clearing activities outside of the buffer. In grassland areas where sensitive species are known to occur (based on surveys), the District would exclude the use of herbicides and would limit the use of mechanical or hand work to the period after June 1. Areas of grassland habitat where spraying will not be permitted will be permanently marked with signs, and the District's GIS system for sensitive species will list these areas (BMP 3.3). The District is committed to avoiding destruction of serpentine habitats and long-term monitoring of populations and distribution of serpentine plants will occur to identify sensitive sites and to avoid future impacts (BMP 3.19).

California Sea-blite

A population of California sea-blite in Santa Clara County was recorded in the area of the Palo Alto Yacht Harbor, near the edge of San Francisco Bay; it is unknown if this population still exists. The SMP is not likely to adversely affect this species because maintenance activities are not expected to occur along coastal marsh edges or where this population has been recorded.

Compensatory Mitigation

The District has incorporated compensatory mitigation into the proposed project. The proposed compensatory mitigation measures include a substantial investment towards the protection and enhancement of the watersheds and streams of Santa Clara County. For impacts to stream vegetation from the sediment removal and vegetation management activities, the mitigation package provides the following components: (1) tidal wetland restoration; (2) freshwater wetland creation; (3) stream and watershed protection; and (4) control of giant reed. The four components of the stream vegetation mitigation package are summarized in Table 3, and proposed sites are shown in Figure 3: Proposed Stream Vegetation Mitigation Sites. Specific details of the proposed compensatory mitigation can be found in the Mitigation Monitoring and Reporting Program, SMP Appendix J, which is contained in the FEIR.

Prior to any ground disturbing activities associated with these mitigation activities, the full range of BMPs will be applied as appropriate to minimize any impacts from the mitigation activities themselves (specifically BMPs 3.1, 3.2, 3.3, and 3.7), and to avoid impacts to sensitive status species which might occur at the mitigation sites.

Implementation of the BMPs would reduce effects, so that the large majority of special-status species would not likely be adversely affected. Residual effects that would likely adversely affect species, would remain for California clapper rail, and California red-legged frog. These effects include:

- Potential loss of approximately 11 acres of foraging habitat for California clapper rails due to sediment removal and vegetation management activities.
- Potential loss of 29.3 acres of California red-legged frog habitat due to vegetation management activities.

In addition, the District is requesting take authorization for California clapper rail and California red-legged frog for the following activities:

- To flush California clapper rails from the work area to appropriate habitat outside of the work area during maintenance activities.
- To capture and relocate individual California red-legged frogs to appropriate habitat outside of the work area, if the location can not be avoided.

Compensatory mitigation directed specifically to offset residual effects to these species are provided below. The District has identified where potential take of listed, candidate, and special concern species may occur. Wherever possible the District has matched its mitigation program to its impacts. The compensatory mitigation program will develop and protect in-kind habitat for these impacts.

California Clapper Rail

The SMP may affect 11 acres of California clapper rail foraging habitat. Under the Tidal Wetland Restoration component of the Compensatory Stream Vegetation Mitigation, the District will restore 30 acres of tidal wetlands, which will be suitable foraging habitat for clapper rail. A diked salt evaporation pond, Pond A4, will be restored to historic tidal marsh conditions. Restoration at Pond A4 will create clapper rail foraging habitat to compensate for impacts from SMP activities. Pond A4 is located immediately adjacent to existing areas used by the species.

The pond is located along South San Francisco Bay, and bordered by Sunnyvale East and West Channels, and Guadalupe Slough. The restoration site is expected to support tidal wetland similar to or of higher quality than the tidal wetlands impacted by repetitive maintenance activities. The pond is under District ownership, and is currently being leased to Cargill Salt Division to continue their salt production operations until 2002.

The tidal wetland restoration concept at Pond A4 consists of lowering the outboard levees or breaching them in several strategic locations to provide full tidal action to the site. It is anticipated that a mosaic of mud flat, tidal wetland, and upland habitats will be created. A combination of natural sedimentation processes and placement of dredge fill is proposed to accelerate restoration of wetland function to the site and create beneficial reuse of clean sediment excavated from tidal streams. Modification of Sunnyvale East Channel may be included in the design to improve its hydraulic performance and eliminate the need for future sediment removal and vegetation management for flood protection purposes.

The Pond A4 project will be coordinated with other large-scale tidal marsh restoration projects proposed for South San Francisco Bay. Because of ground subsidence, reuse of clean fill material may be necessary to supplement natural sedimentation in order for wetland features to develop in the short term. Control of perennial peppergrass, an invasive species that has infested brackish and freshwater marshes in the South San Francisco Bay, will be included. An operations and management plan will be developed as part of the planning study for the Pond A4 Tidal Wetlands Restoration Project. The operations and management plan will identify predator control measures needed to protect species of concern that may be present at the site. Because the site will not include suitable nesting habitat for California clapper rail, we do not expect to develop predator control measures that would protect California clapper rail nesting habitat.

Planning and design of the Pond A4 tidal restoration or currently underway, and the following milestones are projected: mitigation and monitoring plan for submittal to the resource agencies-May 2005, detailed design-May 2007, and construction-summer 2007. The first phase of restoration on the 300-acre pond will include 30 acres credited as mitigation for the SMP. A mitigation banking instrument and funding strategy will be developed, as well as a monitoring program. The time line in which a fully functioning tidal wetland will be established at this site will depend on the preferred alternative selected through the planning process. Some of the key issues to be resolved that will significantly affect the time line for the establishment of tidal wetland habitat is whether or not the preferred plan will re-use dredge sediment to raise the pond bottom elevation, the size of the initial restoration project, and the availability of sediments, both naturally occurring and dredged sediments. Using a combination of dredge material and natural sedimentation would accelerate the restoration of tidal wetland at the site. If sediment re-use is determined to be a major design feature of the preferred alternative, the final decision on whether or not to re-use sediment will rest with the District's Board of Directors through their certification of the EIR for the Pond A4 project and the permitting agencies based on the permit applications that will be submitted by 2005.

While it is premature to explicitly identify the time line for completely restoring Pond A4 to a tidal wetland, gross estimates can be made based on other similar projects in the Bay area. In the event that the selected plan provides for a combination of sediment re-use and natural sedimentation, a low marsh, comprised of California bulrush, can be expected to begin colonizing the mudflat areas within the first few years after the tidal regime is restored. As sediment accumulates, a mean high water marsh plain, comprised of California bulrush, alkali bulrush and cattails, can be expected to develop 5 to 10 years later. It is likely that California bulrush will continue to dominate the low marsh, as the tidal wetland ecosystem develops over a period of 10 to 20 years. Thus, as bulrush vegetation incrementally develops on the site, clapper rail foraging habitat will progressively develop just as foraging habitat will be incrementally disturbed over the ten-year period by SMP work activities. If the selected plan relies exclusively on natural sedimentation, complete restoration of a tidal wetland ecosystem, comprised of vegetated marsh zones, large tidal channels and smaller drainage networks, may take an additional 10 or more years.

At this time, the District is preparing a planning study for the entire 310-acre pond but may restore the pond in multiple phases. In addition to the planning study, the first phase of the project will design a minimum of 120-acres to be restored in the near-term. The 120-acre is intended to provide mitigation for the SMP (30-acres) and other near-term projects, including the Lower Guadalupe River Flood Control Project, that are expected to require tidal wetland mitigation. The remaining 190-acres may be restored at the same time as the initial 120-acres or they may be restored in later phases, depending on the results of the alternatives analysis completed during the planning study. The District's Board of Directors will be determining how they want to use the remaining 190-acres in October 2001. The alternatives include (1) providing environmental enhancements above and beyond that required for mitigation, (2) developing a single user (District-only) or multi-user public agency mitigation bank, or (3) both enhancements and a mitigation bank. Subsequent phases of the project will be implemented to design and restore the acreage that is not included in the first phase of the project to provide for these uses. Any environmental regulatory authorizations required to complete these projects, including a mitigation banking agreement, will be pursued during the approval process for the individual projects and not as part of the Multi-year Stream Maintenance Program.

California Red-Legged Frog

In the Program EIR for the SMP, the District identified 6 California red-legged frog watersheds which would be affected by routine stream maintenance activities. For each of these watersheds, the District is providing 18 acres of stream and associated upland habitat as mitigation (108 acres total). Of these preserved areas, the District will protect a minimum of two streams that are known to support California red-legged frogs. All 108 acres will be located in Santa Clara County. At least one site will in the Santa Cruz Mountains and one site will be in the Diable Range to help facilitate protection of the metapopulation dynamics of the species.

In addition, the District is protecting an additional 712 to 972 acres of stream and associated upland habitat which may benefit California red-legged frogs, and is part of the mitigation for impacts to wetlands from the SMP under the Stream and Watershed Protection Program. Details of this mitigation is summarized in the Mitigation Monitoring and Reporting Program, SMP Appendix J, which is contained in the FEIR.

For this Biological Assessment, the District evaluated in more detail the distribution of California red-legged frogs and their potential habitat in relation to the SMP (Figure 5). We identified several areas where overlap occurs. Each of these sites was evaluated for the potential affects on frogs based on the location of the frog population, the conditions of the facility where overlap occurs, and the intervening landscape (Table 9). Based on this review the District anticipates 29.3 acres of red-legged frog habitat to be potential affected by the SMP. As described above, the District will protect 108 acres of California red-legged frog habitat as mitigation for these effects, under the Stream and Watershed Protection Program.

Lands purchased and preserved under the Stream and Watershed Protection Program are expected to occur primarily in the upper watershed, and thus match the potential locations where SMP activities might affect red-legged frogs in the foothill regions above the densely urbanized valley floor. Lands included in the Stream and Watershed Protection Program can occur in the lower watershed, however, because of development patterns and land costs, parcels with suitable conditions for this type of mitigation are more likely to be located in the upper watershed. See Attachment E for criteria for selecting land under the Stream and Watershed Protection Program which would qualify as credit for red-legged frog mitigation.

Interrelated and Interdependent Actions

The Stream Maintenance Program has been prepared as a comprehensive program to include all routine maintenance activities in streams and canals within the District's jurisdiction, thus all interrelated and interdependent actions are included within the program. In particular, the minor stream maintenance activities described above include those activities which support the major functions of sediment removal, vegetation management and bank protection. There are no other activities which take place at another location or later date and which would cease to occur if SMP activities were not undertaken. Rather, routine stream maintenance activities tend to be interrelated and interdependent actions of other activities such as constructing flood protection and water supply facilities. However, to clarify this point, some of the activities included in the program are described further below.

Maintenance of existing permanent access roads is included as an activity under the SMP, and was evaluated for effects on special status species. Routine maintenance work on roads consists of removing weedy vegetation and grasses by mechanical mowing or hand removal or by spraying with herbicides, and this activity is included in the upland vegetation management. Roads are also graded to restore their surface, and over the past four years, this activity has ranged from 1 to 24 miles annually. Maintenance roads may also be replaced if they are eroded. These activities are included in the SMP as minor work. The construction of temporary access roads during sediment removal and installation of bank protection projects is also included as part of the SMP.

As a part of the project, activities associated with roads would need to be consistent with the BMPs and would be included in any preconstruction surveys as set forth in BMP 3.1. Maintenance of existing roads and construction of new temporary or permanent roads are specifically addressed by BMP 2.2. Any new permanent roads that might need to be constructed as part of a new bank protection project would be designed, evaluated and, if necessary, mitigated for as would the rest of the bank protection project as described in Attachment C. Currently, removing existing roads is not contemplated as a part of the SMP since that might thereafter require that equipment drive down the channel or through a riparian corridor, although the removal of access roads could be considered in new CIPs. Removal of maintenance roads could be evaluated as part of a future HCP.

The potential for erosion that may occur as an indirect effect of sediment removal and bank protection was evaluated in the Geomorphology chapter of the DEIR (DEIR pp. IV-A-23 and IV-A-26) and BMPs 1.13 and 1.15 were developed to address these effects. These BMPs include the possible use of rock vortex weirs, downstream energy dissipation features such as pools or grade control structures, or similar designs. Although they may not consist entirely of nonstructural approaches, the use of coir logs, riparian plantings, and strategic placement of rock and flow deflectors which contain natural or biotechnical components are suggested as a way to respond to site conditions which cannot be changed and may otherwise result in erosion. Vortex rock weirs and other methods such as the "w" rock weir were designed by Dave Rosgen as geomorphic solutions to such problems as excess shear banks, sediment transport capacity and downcutting channels. In addition, they provide pools that enhance fish movement downstream.

The cumulative effect of hardscape in bank protection projects was evaluated in the Biology chapter of the DEIR and FEIR (DEIR pp. IV-B-71 through IV-B-75 and IV-B-99 through IV-B-104; FEIR pp. IV-17 through IV-19). Limitations to the amount of hardscape which can be installed, revisions made to the design process, and mitigation as described in Attachment C greatly reduce the potential level of cumulative effects from hardscape bank protection projects. As a result, these actions are expected to result in a net increase in streamside habitat from the bank protection program.

CUMULATIVE EFFECTS

Cumulative effects of maintenance can occur as a result of the same activities repeated at the same location, different types of routine maintenance occurring at the same location, District CIPs, and projects by other agencies and property owners in habitat of species of special concern.

Cumulative Effects of Stream Maintenance

The SMP has been prepared as a comprehensive program to include all routine maintenance activities in streams and canals within the District's jurisdiction over a long term, thus cumulative effects of the SMP over time and throughout the county are included within the program. Indeed, one of the main motivations for preparing the SMP was the opportunity to evaluate cumulative effects and deal comprehensively with maintenance impacts and mitigation on an effective regional scale.

Most of the individual maintenance activities included in the SMP take place repeatedly on a limited number of District channels (approximately 200 miles out of 828 miles within the District's jurisdiction). These reaches are also those most affected by existing baseline urbanization and geomorphological factors that cause sediment deposition or erosion. In many creek sections, both sediment removal and aquatic herbicide application are undertaken, but in different years within the facility's particular maintenance cycle. For example, sediment removal may be conducted in year one. The following year, herbaceous wetland vegetation may begin to establish where the sediment was removed. In year three, vegetation may be sufficiently established to pose a potential flood hazard, so herbicide is applied to kill the targeted vegetation. Herbicide application may continue in subsequent years. In the meantime, sediment accumulates until it eventually reaches a point where flood capacity is significantly reduced and sediment removal is again required.

Table 12 represents the projected area wetlands and riparian vegetation affected by the SMP. For estimating effects to wetland and riparian vegetation, once an area is affected for any given reach of stream, subsequent effects to the same reach of stream (whether from sediment removal or herbicide application) are not progressively added to the total acres affected. This assessment method is relevant because permanent compensatory mitigation is proposed for the temporary but repetitive effects of the SMP. Anecdotal observation as well as specific surveys in the county have found that wetland vegetation often quickly re-establishes following sediment removal. Rankin and

Hillman (District 1999) found over 40 percent average re-growth within one year after sediment removal at eight study sites. Furthermore, in any given year, maintenance activities take place in only a portion of the total maintenance program work area, allowing vegetation re-establishment in other areas. Refer to p. IV-B-62 of the DEIR for a more extensive discussion of the one-time accounting method for stream vegetation impacts and mitigation.

Cumulative Effects with Other District Projects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA. Future federal actions that are unrelated to the proposed action are not considered in this section because they will be subject to separate consultation pursuant to Section 7 of the ESA.

The effects of District maintenance are cumulative with other District activities that may affect the same channels in Santa Clara County. Table 13 lists other future District projects in creeks, however, all of these projects are either 1) unrelated to the proposed action and are future federal actions because they will require permits from the Corps under the Clean Water Act, 2) not reasonably certain to occur in the action area as indicated by the fact that an environmental evaluation has not been prepared or 3) both. Thus, these are not cumulative effects as defined under the federal Endangered Species Act.

The District also takes steps to control urban runoff pollution from District facilities and from projects conducted by others which the District reviews. See Attachment G to this document for a description of these efforts.

Cumulative Effects with Non-District Projects

Cumulative effects could also occur as a result of actions taken by other agencies or private parties in Santa Clara County, particularly land development which could adversely affect habitat. The streams of Santa Clara County are affected by numerous activities outside of the District's control. Some of the regional effects are being explored through programs such as the Watershed Management Initiative (WMI). For more information see SMP, Chapter 6. The mission of the WMI is to protect and enhance the watershed, creating a sustainable future for the community and the environment. The participants will work toward the development and implementation of an integrated watershed management approach to address water pollution and improve the condition of the Santa Clara basin. Other regional effects are considered in the DEIR in an extensive discussion of the General Plans of the cities and the County that affect Santa Clara County streams. The DEIR, (p. II.E-4) lists individual projects or activities conducted by others that may cumulatively impact the streams.

By 2010, the population of Santa Clara County is expected to be 1.8 million persons, 160,000 more than in 2000. This is a more moderate rate of growth than in the 1950s and 1960s. Most of the population growth is expected to occur in the City of San Jose, and, to a lesser extent, in the Cities of Morgan Hill and Gilroy and unincorporated south county area (Santa Clara County 1994, Silicon Valley Manufacturing Group 2000). New commercial and housing development would convert open space and agricultural lands on the urban fringes of Silicon Valley which might provide habitat for sensitive species.

Currently, it is estimated that of the approximately 830,000 undeveloped or lightly developed acres (less than one unit per acre) in Santa Clara County, approximately 100,000 acres are at risk of development over the next 30 years. Two areas of particular risk are Coyote Valley and south Santa Clara County. A 400-acre office campus is proposed in the northern portion of Coyote Valley which could subsequently trigger development of the 1,400-acre North Coyote Industrial Area and construction of new housing units in Santa Clara County. Prime farmland between the cities of Morgan Hill and Gilroy, and east and west of Gilroy are also subject to future development (Greenbelt Alliance 2000).

Santa Clara County (including the Santa Clara Valley Transportation Agency) and the City of San Jose have agreed to prepare a multi-species Habitat Conservation Plan/Natural Communities Conservation Plan to address impacts to federally-listed species and their habitat in Santa Clara County from their projects. This multi-species HCP should evaluate and address potential cumulative effects of future land development in Santa Clara County. The District has agreed to cooperate with this effort in order to clear the way for USFWS approvals of District actions.

ANALYSIS OF ALTERNATE ACTION

The alternatives analysis focused on the ways that the long-term, cumulative impacts of routine maintenance could be reduced. Several alternatives were analyzed in the DEIR. In response to comments, the District designated the Modified Pajaro River Basin Alternative as the Preferred Alternative in the FEIR, rather than the Multi-Year Program Alternative. Under the Modified Pajaro River Basin Alternative, herbicides would continue to be the primary method by which vegetation is managed in the Santa Clara Basin. Because of concerns regarding the gradual environmental change to wetlands, herbicide use in the Pajaro River Basin would be limited to upland areas and to control of non-native invasive plants.

The proposed project is adoption of the SMP and implementation of its work performance protocol and programmatic mitigation. The proposed SMP is characterized as the Modified Pajaro River Basin Alternative (Preferred Alternative). The Existing Program Alternative represents the District not adopting the SMP and continuing the current practice of routine maintenance on an annual basis. The No Work Alternative would eliminate all maintenance in streams and canals by the District within its jurisdiction. The Multi-Year Program Alternative differs from the Modified Pajaro River Basin Alternative in that herbicides would be used to manage vegetation in the channels of the Pajaro River Basin. The Reduced Work Alternative would eliminate work in unmodified channels, and does not include hardscape bank protection. The No Herbicides Alternative reduces the amount of area treated with herbicides.

The main differences between the alternatives are: (1) the amount of flood protection provided; (2) the amount of stream vegetation affected; and (3) the amount of area treated with herbicide. Other areas of potential impact do not vary appreciably among alternatives. As with the Preferred Alternative, other potential impacts can be avoided or reduced to insignificance with the same BMPs or a version of the compensatory mitigation program incorporated in the project.

When screening potential alternatives for this program, the District initially considered multiple combinations of design methods, service levels, impact analysis, mitigation packages, and approaches to environmental review and permitting. Over one dozen combinations were examined in further detail, screened for feasibility, and evaluated as to whether they responded to the program objectives, requirements of environmental regulations, and comments from agencies and internal and external stakeholders. The Multi-year Program Alternative is summarized first because it is the former preferred alternative. Following are the five alternatives which were identified for analysis because they meet all or most of the program purposes. The Modified Pajaro River Basin Alternative is designated as the Preferred Alternative. Table 14 defines the basic elements of each alternative.

1. Multi-Year Program

The Multi-Year Program as described in detail in the DEIR, includes sediment removal, vegetation management, bank protection and minor associated work. Projected levels of work are based on historical levels with minor adjustments made for foreseeable future changes. The extent of work under the Multi-Year Program would be 58 miles of sediment removal and 246 miles of channel vegetation management. The extent of maintenance is defined as the total length or area on which stream maintenance will repeatedly take place.

Initial impacts to stream vegetation would consist of 108 acres of freshwater wetlands, 30 acres of tidal wetlands and 67 acres of riparian vegetation. Herbicides would be used for vegetation management in both the Santa Clara Basin and Pajaro River Basin. Over time, with the use of herbicides in the Pajaro River Basin where hand and mechanical methods are currently used, it is projected there would be seasonally less wetland vegetation in the channels of the Pajaro River Basin.

BMPs as incorporated in the SMP would avoid or reduce many impacts. A compensatory mitigation program for impacts to stream vegetation from the sediment removal and channel vegetation management activities would consist of restoring 30 acres of tidal wetland, creating 14 acres of freshwater wetlands, preserving and enhancing 920 to 1,210 acres of stream and watershed, and control of 125 acres of giant reed.

The bank protection work would include both hardscape and softscape designs with a programmatic exchange of mitigation between designs which limit biotic potential and those which tend to retain it.

2. Existing Program Alternative

The Existing Program Alternative represents a continuation of current maintenance practices with minor foreseeable future changes. The Existing Program Alternative includes the same amount of sediment removal, vegetation management, bank protection and minor activities as the Modified Pajaro River Basin Alternative Program. These alternatives will not include the use of herbicides in the Pajaro River Basin since that is not the existing practice.

The Existing Program Alternative will continue to affect 108 acres of freshwater wetlands, 30 acres of tidal wetlands, and 67 acres of riparian vegetation, and the amount of stream vegetation will not change over the long term.

As with the Modified Pajaro River Basin Alternative, current BMPs will be used and new BMPs will be developed, as new information becomes available.

The District will apply for permits each year from the various regulatory agencies for new projects. The requirements for mitigation will be negotiated each year and mitigation projects will be developed or managed individually rather than as a program. It is assumed under this alternative, that during negotiation of annual permits, the baseline for assessing impacts and estimating mitigation would be the same as for the Modified Pajaro River Basin Alternative, with the inclusion of the one-time accounting method. That is, mitigation would be provided for all impacts to tidal wetlands, freshwater wetlands, and riparian vegetation from sediment removal and vegetation management, but over the years, new mitigation would not be offered for repeated activities in the same channel reach. Over time, compensatory mitigation would consist of the same four components as described for the Modified Pajaro River Basin Alternative, but because mitigation is negotiated each year, the implementation may be more spread out and not as coordinated.

Bank protection projects would be designed, reviewed under the CEQA, permitted, and installed on an individual basis. It would be more difficult to exchange mitigation credit between different types of bank protection designs if they are not managed as a program. Cumulative impact analysis would be more difficult if not managed as a program.

Under the Existing Program Alternative, it would be more difficult to reassess cumulative impacts of stream maintenance after several years since projects are evaluated on an annual and case-by-case basis only.

The same amount of flood protection would be provided as under the Modified Pajaro River Basin Alternative; however, because of the greater expense of the hand and mechanical methods compared to herbicide use for vegetation management, average annual costs would increase approximately. See Table 15 for a cost comparison of the alternatives.

3. No Work Alternative

The No Work Alternative discontinues all maintenance of streams, canals and associated District facilities. Geomorphic adjustments would occur. If maintenance ceased, the stream channels would develop a more meandering pattern and the evolution of a low flow channel would begin. Tidal channels would fill in with sediment and the channel would change alignment. Establishment of a fully geomorphic alignment would be constrained by development along the creek and by the maintenance of property, homes, roads and bridges by individuals and by other agencies.

Over time, these facilities would fill in with more sediment and in many cases with more vegetation. The reduction in short-term, recurring disturbance would allow a greater amount of wetland to become established in channels and a greater opportunity for riparian forest to establish on sandbars. In some channels, however, the existing maintenance program is creating conditions conducive to wetland vegetation, and at these locations, sediment buildup would reduce the amount of stream vegetation, or eventually shift it towards more riparian or upland species rather than wetland.

No impacts to stream vegetation by the District would occur as the result of maintenance under this alternative, therefore, no mitigation would occur.

The No Work Alternative would cause significant threat of flooding to areas that have been removed from the flood hazard designation as a result of flood protection projects constructed by the District.

The main reason for the proposed project is to provide adequate flood protection, which would not be provided if this alternative was implemented. The estimated number of parcels and acreage that would be impacted are shown below in Table 16.

Owners of properties that are in a flood plain are required to maintain a flood insurance policy for each property. Depending on the location, the flood insurance policy for a typical residential property can cost a property owner from $300 to $1,000 a year. Using the lower flood insurance rate of $300/year, the potential flood insurance cost to residential properties alone from the No Work Alternative is approximately $23.2 million a year.

4. No Herbicides Alternative

The No Herbicides Alternative assumes no use of herbicides in routine stream or canal maintenance. Instead, herbicide treatment of vegetation in the Santa Clara Basin will be replaced by mechanical and hand methods in those areas in which herbicides are currently used. As is currently the practice, no herbicides will be used in the Pajaro River Basin. The No Herbicides Alternative includes the same amount of sediment removal, vegetation management, bank protection and minor activities as the Modified Pajaro River Basin Alternative.

Initial impacts to stream vegetation would consist of 106 acres of freshwater wetlands, 30 acres of tidal wetlands and 66 acres of riparian vegetation. Over time, with the cessation of herbicide use in the Santa Clara Basin, there would be more vegetation present in the channel, and long-term impacts to stream vegetation would be 125 acres of freshwater wetlands, 31 acres of tidal wetlands, and 97 acres of riparian vegetation. The biological impacts would be reduced under this alternative, because vegetation would be trimmed back instead of being killed, allowing wildlife cover, roosting, feeding and nesting opportunities for a period of a few months every year before it is removed. Vegetation would be removed by mechanical and hand methods later in the season than if it were to be removed by herbicide use, thus providing habitat for migratory birds that arrive before work commences. This is a beneficial effect to biological values. On the other hand, a greater amount of vegetation will be removed by more disruptive methods every year, although it will occur after the breeding season.

The same BMPs would be applied except for those which are relevant only to herbicide use. The mitigation program would be the same as for the Modified Pajaro River Basin Alternative. The approach to multi-year CEQA review and permits would be the same as under the Modified Pajaro River Basin Alternative. The same amount of flood protection would be provided as under the Modified Pajaro River Basin Alternative, however, because of the greater expense of the hand and mechanical methods compared to herbicide use for vegetation management, average annual costs would increase.

5. Modified Pajaro River Basin Alternative

The Modified Pajaro River Basin Alternative is similar to the Multi-Year Program except that it will not include the use of herbicides in stream channels of the Pajaro River Basin unless they are for the control of non-native, invasive plants. Instead, hand and mechanical methods will continue to be used to control vegetation in the Pajaro River Basin stream channels. Herbicides will be used on 157 acres in adjacent upland areas in the Pajaro River Basin, and in channels, canals and associated upland areas in the Santa Clara Basin.

The Modified Pajaro River Basin Alternative includes the same amount of sediment removal, vegetation management, bank protection and minor activities as the Multi-Year Program.

Initial impacts to stream vegetation would consist of 106 acres of freshwater wetland, 30 acres of tidal wetland, and 66 acres of riparian vegetation and this amount would not change over time since there is no conversion of vegetation management types in the channel. This would result in a greater amount of in-channel vegetation in the Pajaro River Basin than under the Multi-Year Program Alternative and would provide a beneficial effect to the streamside habitat because vegetation would be trimmed back instead of being killed, allowing wildlife cover, roosting, feeding and nesting opportunities. This would also result in less streamside habitat fragmentation caused by vegetation management activities. However, the annual amount of stream vegetation removed in the Pajaro River Basin would be greater than for the Multi-Year Program Alternative over the long term, and the method would be temporarily more disruptive to resident wildlife.

The BMPs and approach to multi-year CEQA review and permits would be the same as under the Multi-Year Program Alternative. Because the impacts are less, the Modified Pajaro River Basin Alternative would include the following compensatory mitigation program: restoring 30 acres of tidal wetland, creating 14 acres of freshwater wetlands, preserving and restoring 820 to 1,080 acres of stream and watershed, and control of 125 acres of giant reed. The same amount of flood protection would be provided as under the Multi-Year Program Alternative; however, because of the greater expense of the hand and mechanical methods compared to herbicide use for vegetation management, average annual costs would increase. See Table 15 for a comparison of cost estimates for each alternative.

6. Reduced Work Alternative

The Reduced Work Alternative would reduce the overall amount of routine stream maintenance work. Sediment removal and vegetation management would no longer take place in unmodified channels except 100 feet upstream and downstream of bridges or road crossings as needed and at stream gages, outfalls, trash racks and other structures as described under the minor work activities. Unmodified channels are channels in which no modifications have been made by the District for flood protection purposes. Unmodified channels may be in a natural condition with stream meanders and trees lining the bank. However, some unmodified channels have been altered by historical land uses and in appearance, are more like a ditch than a natural channel. Maintenance activities in canals would be the same as under the Modified Pajaro River Basin Alternative. Herbicide use would resume in the Pajaro River Basin. The extent of work under the Reduced Work Alternative would be 55 miles of sediment removal and 142 miles of channel vegetation management (Figure 13: Multi-year Stream Maintenance Program Reduce Work Alternative - All Activities). Control of invasive non-native plants could be undertaken in unmodified channels under the Reduced Work Alternative.

This alternative would not include any hardscape designs in the bank protection program. The number and length of sites which can be suitably designed with softscape in the future is not known, therefore the only prediction which can be made about the amount of future bank protection under this alternative is that it will average less than 2,500 feet per year. Other stream bank projects will be completed under individual CEQA review and permits. None of the geomorphic or biological impacts related to hardscape bank protection would result from this alternative, thus resulting in beneficial effects.

TABLE 3
Compensatory Stream Vegetation and Special-Status Species Mitigation

Mitigation Component	Location	Size of Mitigation	Compensates for Impacts to:	Description	Installation Date
Tidal Wetland Restoration	Pond A-4	30 acres	30 acres of tidal wetlands: • 29 acres from sediment removal • 1 acre from vegetation management. Will provide foraging habitat for California clapper rail and black rail.	Restore diked salt evaporator pond to historical tidal marsh conditions	2007
Freshwater Wetland Creation	Three sites currently identified:		14 acres of freshwater wetland in stream channels: • 10 acres in Santa Clara Basin • 4 acres in Pajaro River Basin		
	• Los Capitancillos	3 acres, Santa Clara Basin		Convert annual grasslands to seasonal or perennial wetlands adjacent to Guadalupe River	2002
	• Coyote Lakes Park Site 10A	7 acres, Santa Clara Basin		Convert ruderal grasslands to near-perennial wetlands adjacent to Coyote Creek	2005
	• Church Pond No. 2	4 acres, Pajaro River Basin		Convert open water in inactive percolation pond to wetland bench	2003
Stream and Watershed Protection	Undeveloped parcels with streams	Approx. 820 to 1,080 acres purchased and additional restored	92 acres of freshwater wetlands: • 74 acres in Sta Cl Basin streams • 11 acres in Paj Bas. streams • 7 acres in canals Includes preservation/restoration of 108 acres of mitigation on land known to support California red-legged frog and western pond turtle.	Preserve, protect, and improve streams and associated watersheds	As lands become available in first 10 years.
Giant Reed Control	Throughout county	125 acres	66 acres of riparian vegetation from vegetation management: • 32 acres in Santa Clara Basin • 34 acres in Pajaro River Basin And 59 acres of the total 125 acres of Giant Reed Control is being provided for lag time in implementing and effective functioning of mitigation components.	Control giant reed outbreaks and provide associated mapping, revegetation, education, and coordination throughout county	2002-2012

TABLE 4
Fish Habitat by Basin

Fish habitat category provided in miles and percent of total miles of channel with recorded fish habitat category.

Fish Habitat Category	**Santa Clara**		**Pajaro River**		**Total**	
	Miles	**%**	**Miles**	**%**	**Miles**	**%**
Trout (7)	20	6%	0	0%	20	6%
Steelhead (6)	30	9%	11	3%	41	12%
Potential Trout (5)	23	7%	8	2%	31	9%
Warm Water Native (4)	18	5%	4	1%	22	6%
Mixed; Spawning (3)	24	7%	0	0%	24	7%
Native/Introduced (2)	51	15%	11	3%	62	18%
Limited (1)	71	21%	19	6%	90	26%
No Value (0)	11	3%	43	13%	54	16%
Subtotal	248	72%	96	28%	344	100%
No Habitat Category Data	339	n/a	144	n/a	484	n/a
Total Miles	587	71%	240	29%[1]	828	100%[1]

Source: SCVWD 2001; Jerry Smith 2001

Note: Numbers are rounded from calculations of category miles. Total District miles = 828.

[1] Percent total District miles; all other percentages represent percent of miles with recorded fish habitat category.

Table 5
Fish Habitat by Channel Type

Fish habitat category provided in miles and percent of total miles for each habitat category.

Fish Habitat Type	Natural (+/-)		Mixed		Concrete		No Data on Channel Type		Total Miles
	Miles	%	Miles	%	Miles	%	Miles	%	
Trout (7)	20	100%	0	0%	<1	<1%	0	0%	20
Steelhead (6)	40	98%	1	2%	0	0%	0	0%	41
Potential Trout (5)	23	74%	7	23%	1	3%	0	0%	31
Warm Water Native (4)	20	95%	<1	<1%	1	5%	0	0%	21
Mixed; Spawning (3)	7	29%	16	67%	1	4%	0	0%	24
Native/ Introduced (2)	20	32%	31	49%	12	19%	0	0%	63
Limited (1)	46	51%	20	22%	25	27%	0	0%	91
No Value (0)	33	61%	15	28%	6	11%	0	0%	54
No Habitat Category Data	99	20%	34	7%	45	9%	306	63%	484
Total	**308**	**37%**	**123**	**15%**	**91**	**11%**	**306**	**37%**	**829**

Source: SCVWD 3/01; Jerry Smith 2001
Note: Numbers are rounded from calculations of habitat type miles.

TABLE 6
Historical Occurrences of San Francisco Garter Snakes in Santa Clara County

Location	Date	Source	Status
Santa Clara County: Palo Alto	1893-1920	California Academy of Sciences - Stanford University Collections; San Francisco, CA	Extinct?
Santa Clara County: Stanford University	1893-1950	California Academy of Sciences - Stanford University Collections; San Francisco, CA	Extant
Santa Clara County: San Francisquito Creek at Junipero Serra Road	1971-1983	Barry, S. J. 1994. The distribution, habitat, and evolution of the San Francisco garter snake, *Thamnophis sirtalis tetrataenia*. Unpublished M.A. Thesis, University of California at Davis iii+140 p.	Extant
Santa Clara County: Lake Lagunita, Stanford University campus	1971-1983	Barry, S. J. 1994. The distribution, habitat, and evolution of the San Francisco garter snake, *Thamnophis sirtalis tetrataenia*. Unpublished M.A. Thesis, University of California at Davis iii+140 p.	Extant

TABLE 7
Potential Effects on California Clapper Rail Habitat

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Matadero Creek	HWY 101	No Impact	Sediment removal is immediately adjacent to U.S. 101 at upstream entrance to Palo-Alto Flood Basin. Stream is lined with trees and shrubs. Area not considered habitat	0.05	Sediment Removal
Permanente Creek	Shoreline Park	No Impact	Herbicide application along maintenance road and upper levee slopes. Rails are known to us adjacent vegetated pond area. Heavy use of area by pedestrians	0.4	Upland herbicide application
	Shoreline Park	Potential Impact	Aquatic herbicide application to control cattails and other emergent vegetation in channel.	0.2	Aquatic Herbicide application
San Francisquito Creek	Mouth to 4,500 ft upstream	No Impact	Herbicide application along maintenance road and upper levee slopes. Rails are known to use adjacent marsh areas for breeding. Heavy use of area by pedestrians and Palo Alto Airport. No rail use of channel.	5.2	Herbicide Application
Stevens Creek	Crittenden Bridge downstream 430 ft	No Impact	Herbicide application along maintenance road and upper levee slopes. Rails are known to use habitat at mouth of creek downstream of site. Heavy use of area by pedestrians and recreationist. Levee slopes and maintenance roads above areas used by rails	1.59	Herbicide Application
	Crittenden Bridge downstream 430 ft	No Impact	Upland mowing of levee slope above areas used by rails.	0.8	Upland Mowing
Palo Alto Flood Basin	Upstream edge of basin	No Impact	Herbicide application along maintenance road and upper levee slopes. Rails unlikely to use this portion of flood basin. No mud flats in open channels.	1.5	Herbicide Application
Calabazas Creek	Mouth to Highway 237	No Impact	Herbicide application along maintenance road and upper levee slopes. 1 rail observed in Caltrans mitigation ponds adjacent to levee in recent past.	0.9	Herbicide Application
	Mouth to Highway 237	Potential Impact	Aquatic herbicide application to control cattails and other emergent vegetation	2.1	Aquatic Herbicide Application
	Mouth to Highway 237	No Impact	Upland mowing of levee slope is above areas used by rails.	3.2	Upland Mowing

TABLE 7
Potential Effects on California Clapper Rail Habitat
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
San Tomas Aquino	Mouth to Highway 237	No Impact	Herbicide application along maintenance road and upper levee slopes. 1 rail observed in Caltrans mitigation ponds adjacent to levee in recent past.	2.4	Herbicide Application
	Mouth to Highway 237	Potential Impact	Sediment removal is downstream of Highway 237. Rails have been sighted in adjacent Caltrans Mitigation Marsh.	4.8	Sediment Removal
Sunnyvale East Channel	Mouth to 790 ft upstream	No Impact	Herbicide application along maintenance road and upper levee slopes. No evidence of clapper rail use of channel. 3 years of clapper rail survey work and 2 years of sora/virginia rail research in channel.	0.6	Herbicide Application
	Mouth to 790 ft. upstream	No Impact	No evidence of clapper rail use of channel. Three years of clapper rail survey work and 2 years of sora/virginia rail research in channel	0.9	Sediment removal
Sunnyvale West	Mouth to Sunnyvale Water Treatment Plant	No Impact	Herbicide application along maintenance road and upper levee slopes. 1 rail record adjacent to treatment plant.	.04	Herbicide Application
	Mouth to Sunnyvale Water Treatment Plant	Potential Impact	Aquatic herbicide application to control cattails and other emergent vegetation	0.02	Aquatic herbicide application
	Mouth to Sunnyvale Water Treatment Plant	No Impact	Mowing of upland areas above habitat used by rails.	0.03	Upland Mowing
Guadalupe River	SPRR Bridge downstream 210 ft	No Impact	Herbicide application along maintenance road and upper levee slopes. 1 rail observed near SPRR bridge in recent past.	4.0	Herbicide Application
	SPRR Bridge downstream 210 ft	Potential Impact	Aquatic herbicide application to control cattails and other emergent vegetation	3.9	Aquatic herbicide application

TABLE 7
Potential Effects on California Clapper Rail Habitat
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	SPRR Bridge downstream 210 ft	No Impact	Upland mowing of levee slope above areas used by rails.	0.4	Upland mowing

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	0.2	Sediment Removal
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	0.2	Channel Hand Removal
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	0.1	Weed Abatement Hand Labor
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	0.3	Upland Herbicide Hand Application
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	1.7	Upland Herbicide Mechanical Application
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with indication red-legged frogs not present. Most of channel is dry. Flows primarily from urban runoff. Creek located in downtown Morgan Hill.	1.8	Mechanical Mowing
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with no frogs found. Channel is ephemeral and only flows during storm events.	0.05	Channel Hand Removal
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with no frogs found. Channel is ephemeral and only flows during storm events.	0.1	Upland Herbicide Hand Application
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with no frogs found. Channel is ephemeral and only flows during storm events.	0.5	Upland Herbicide Mechanical Application

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	West Little Llagas Creek	No Impact	Area described has been surveyed multiple times by District with no frogs found. Channel is ephemeral and only flows during storm events.	0.00	Mechanical Mowing
Diablo Range Habitat	Calera Creek	No Impact	Multiple surveys indicate frogs not present on ephemeral creek. Flows from urban runoff. Site downstream of Interstate 680. Site located in urban environment	0.6	Aquatic Herbicide Application
	Calera Creek	No Impact	Multiple surveys indicate frogs not present on ephemeral creek. Flows from urban runoff. Site downstream of Interstate 680. Site located in urban environment	0.3	Upland Herbicide Hand Application
	Calera Creek	No Impact	Multiple surveys indicate frogs not present on ephemeral creek. Flows from urban runoff. Site downstream of Interstate 680. Site located in urban environment	3.4	Upland Herbicide Mechanical Application
	Calera Creek	No Impact	Multiple surveys indicate frogs not present on ephemeral creek. Flows from urban runoff. Site downstream of Interstate 680. Site located in urban environment	0.1	Overhangin g Growth
	Berryessa Creek	No Impact	Ephemeral Creek. Multiple frog surveys indicate no red-legged frogs. Sites located in urban environment	0.3	Upland Herbicide Mechanical Application
	Berryessa Creek	No Impact	Ephemeral Creek. Multiple frog surveys indicate no red-legged frogs. Sites located in urban environment	0.1	Upland Herbicide Hand Application
	Los Coches Creek	No Impact	Site located in urban environment. Channel concrete lined with steep gradient. Creek may be ephemeral. Surveys indicate no red-legged frogs in area	0.04	Sediment Removal
	Los Coches Creek	No Impact	Site located in urban environment. Channel concrete lined with steep gradient. Creek may be ephemeral. Surveys indicate no red-legged frogs in area	0.01	Sediment Removal
	Los Coches Creek	No Impact	Site located in urban environment. Channel concrete lined with steep gradient. Creek may be ephemeral. Surveys indicate no red-legged frogs in area	0.04	Upland Herbicide Hand Application

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Los Coches Creek	No Impact	Site located in urban environment. Channel concrete lined with steep gradient. Creek may be ephemeral. Surveys indicate no red-legged frogs in area	0.1	Aquatic Herbicide Application
	Miguelita Creek	No Impact	Site located in urban environment. Multiple surveys indicate no red-legged frogs in area	0.1	Hand Removal
	Miguelita Creek	No Impact	Site located in urban environment. Multiple surveys indicate no red-legged frogs in area	1.0	Upland Herbicide Hand Application
	Coyote Creek	No Impact	Coyote Creek located in rapidly urbanizing area. Creek supports multiple red-legged frog predators	1.9	Aquatic Herbicide
Alum Rock Park	Upper Penitencia Creek	No Impact	Upper Penitencia Creek downstream of Doral Road is located in urban environment. No suitable upland habitat adjacent to creek. Creek and percolation ponds adjacent to creek support predatory species of red-legged frogs	0.5	Aquatic Herbicide Application
	Upper Penitencia Creek	No Impact	Upper Penitencia Creek downstream of Doral Road is located in urban environment. No suitable upland habitat adjacent to creek. Creek and percolation ponds adjacent to creek support predatory species of red-legged frogs	0.3	Upland Herbicide Hand Application
	Upper Penitencia Creek	No Impact	Upper Penitencia Creek downstream of Doral Road is located in urban environment. No suitable upland habitat adjacent to creek. Creek and percolation ponds adjacent to creek support predatory species of red-legged frogs	0.5	Upland Herbicide Mechanical Application
Evergreen Valley	Thompson Creek	No Impact	Thompson Creek is an ephemeral creek in an upland environment. Surveys indicate that no red-legged frog habitat present along the creek. Remnant populations in area have likely been extirpated by urban development.	0.3	Upland Herbicide Hand Application
Diablo Range	Coyote Canal	No Impact	Coyote Canal supports predators of red-legged frog. Site is dried on annual basis during winter months when it only carries storm flows. Multiple years of surveys indicate species is not present in canal.	0.3	Aquatic Herbicide Application

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Coyote Canal	Potential Impact	Coyote Canal supports predators of red-legged frogs. Site is dried on annual basis during winter months when it only carries storm flows. Multiple years of surveys indicate red-legged frog present north of twin pipes but not south of twin pipes	6.5 acres of overlap but 1.2 acres of potential impact	Aquatic Herbicide Application
	Coyote Canal	Potential Impact	Coyote Canal is within Bay Checkerspot Butterfly critical habitat but flows through an area that is not considered habitat for the butterfly and may support frog use in uplands.	0.7	Upland Herbicide Mechanical Application
	Coyote Canal	Potential Impact	Areas east of U.S. 101 are no upland spray zone for Bay Checkerspot Butterfly. Areas west of U.S. 101 are within spray zone.	15.3 acres of overlap but 3.0 acres of potential impact	Upland Herbicide Mechanical Application
-	Coyote Canal Extension	Potential Impact	Area is adjacent to known red-legged frog areas. No surveys have been conducted by District.	3.4	Aquatic Herbicide
	Coyote Canal Extension	No Impact	Area is in critical habitat for Bay Checkerspot Butterfly and is a no upland spray zone	16.8	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	0.6	Aquatic Herbicide

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	1.3	Discing
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	0.4	Weed Abatement
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	1.9	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	1.6	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Canal is concrete lined and dry during most of the year. Used as a drainage channel only. Canal is located west of Coyote Creek percolation ponds and Parkway Lakes Fishing Lakes harbor multiple types of predators. Canal is also located west of two major highways away from known populations of frogs and bordered by urban development.	0.4	Mowing

TABLE 9
Potential Effects on California Red-legged Frog Populations
(Continued)

Population Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Calero Hills	Almaden-Calero Canal	No Impact	Canal is dry during most of the year. Only used to transport winter flows from Almaden Reservoir to Calero Reservoir. Several small pockets of water in low spots support bullfrogs.	3.0	Aquatic Herbicide
	Almaden-Calero Canal	No Impact	Canal is dry during most of the year. Only used to transport winter flows from Almaden Reservoir to Calero Reservoir. Several small pockets of water in low spots support bullfrogs.	1.4	Upland Herbicide Mechanical
	Almaden-Calero Canal	No Impact	Canal is dry during most of the year. Only used to transport winter flows from Almaden Reservoir to Calero Reservoir. Several small pockets of water in low spots support bullfrogs.	14.4	Upland Herbicide Mechanical

TABLE 10
Potential Effects on California Tiger Salamanders

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Santa Cruz Mountains Habitat Area	Adobe Creek	No Impact	Tiger Salamanders do not use in-stream environments. Area of overlap is urbanized portion of the creek and includes parking lots at Foothill College	0.9	Aquatic Herbicide
	Adobe Creek	No Impact	Area is located in urbanized area with numerous roads in vicinity and no pond habitat nearby. Area is bordered by Moody Road and Adobe Lane	0.3	Upland Herbicide Hand Application
San Francisquito Creek	*San Francisquito*	No Impact	Area is bordered by urban residential areas to the west and by apartment complexes to the east. Major roads (Willow Road) borders the apartment complex. Tiger salamander access to site is unlikely. Tiger salamanders are not known to use streams.	5.6	Aquatic Herbicide
Santa Cruz Mountains Habitat Area	Alamitos Creek	No Impact	Tiger salamanders do not use in-stream environments. Site is located in urban environment.	16.1	Aquatic Herbicide
	Alamitos Creek	No Impact	Overlap area is in urban environment of Almaden Valley. Houses and urban streets border the creek on both side of the creek	1.8	Upland Herbicide Hand Application
	Alamitos Creek	No Impact	Overlap area is in urban environment of Almaden Valley. Houses border the creek on both side of the creek	9.1	Upland Herbicide Mechanical Application
	Alamitos Creek	No Impact	Overlap area is in urban environment of Almaden Valley. Houses border the creek on both side of the creek	8	Discing
	Alamitos Creek	No Impact	Overlap area is in urban environment of Almaden Valley. Houses border the creek on both side of the creek	2.8	Mowing

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Calero Creek Population and Santa Cruz Mountains Habitat Area	Calero Creek	No Impact	Tiger salamanders do not use in-stream environments	0.6	Aquatic Herbicide
	Calero Creek	No Impact	Tiger salamanders do not use in-stream environments	3.0	Hand Removal in Channel
	Calero Creek	No Impact	Calero Creek traverses Almaden Valley. Work area is limited to urban environment downstream of Harry Road and adjacent to residential streets.	8.0	Upland Herbicide Mechanical
Almaden Quicksilver and Santa Cruz Mountains Habitat Area	Golf Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. Houses and streets border the creek on either side.	0.0	Sediment Removal
	Golf Creek	No Impact	Tiger salamanders do not use in-stream environments. Area of overlap is in urban environment.	1.1	Aquatic Herbicide
	Golf Creek	No Impact	Area is located in urban environment. Streets and houses border the creek along most of its length. Existing golf course at head of creek not conducive to tiger salamanders	2.3	Upland Herbicide Mechanical Application
	Golf Creek	No Impact	Area is located in urban environment. Streets and houses border the creek along most of its length. Existing golf course at head of creek not conducive to tiger salamanders	1.1	Upland Herbicide Hand Application

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Golf Creek	No Impact	Area is located in urban environment. Streets and houses border the creek along most of its length. Existing golf course at head of creek not conducive to tiger salamanders	2.0	Mowing
	Golf Creek	No Impact	Type of work does not pose a *problem for tiger* salamanders. Area is located in urban environment. Streets and houses border the creek along most of its length. Existing golf course at head of creek not conducive to tiger salamanders	0.2	Overhanging growth
Santa Cruz Mountains Habitat Area	Greystone Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. With houses streets and schools bordering the creek.	0.3	Sediment Removal
	Greystone Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	1.0	Weed Abatement
	Greystone Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	2.3	Upland Herbicide Mechanical Application
	Greystone Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	0.9	Upland Herbicide Hand Application
	Greystone Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	1.0	Mowing
	Greystone Creek	No Impact	Tiger salamanders do not use in-stream environments.	1.5	Aquatic Herbicide
	Greystone Creek	No Impact	Type of work does not affect tiger salamanders	0.6	Overhanging Growth

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Santa Teresa	No Impact	Santa Teresa Creek is a tributary of Calero Creek in Almaden Valley. Tiger salamanders may have access to the site. BMP 3.1 will be used to determine presence of tiger salamanders prior to any work being conducted. If salamanders are found on-site alternative methods of clearing site will be investigated.	3.0	Discing
	Santa Teresa	No Impact	Santa Teresa Creek is a tributary of Calero Creek in Almaden Valley. Tiger salamanders may have access to the site. BMP 3.1 will be used to determine presence of tiger salamanders prior to any work being conducted. If salamanders are found on-site alternative methods of clearing site will be investigated.	0.8	Upland Herbicide Hand Application
	Randol Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	0.5	Weed Abatement
	Randol Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	1.5	Mowing
	Randol Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. With houses streets and schools bordering the creek.	1.0	Aquatic Herbicide
	Randol Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	8.0	Upland Herbicide Mechanical Application

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Randol Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	2.5	Upland Herbicide Hand Application
	Randol Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. With houses streets and schools bordering the creek.	1.0	Sediment Removal
	Randol Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. With houses streets and schools bordering the creek.	0.4	Aquatic Herbicide
	Randol Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	2.5	Discing
	Randol Creek	No Impact	Type of work does not affect tiger salamanders	0.5	Overhanging Growth
Mt. Diablo Range Habitat Area	Norwood Creek	No Impact	Norwood Creek debris basin is located at the wildland urban interface. Tiger salamanders may be present on grazing lands upslope from debris basin. BMP 3.1 will be used to determine presence of tiger salamanders prior to any work being conducted. If salamanders are found on-site alternative non-impactive methods of clearing site or a change in timing of work will be investigated.	0	Aquatic Herbicide

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Norwood Creek	No Impact	Norwood Creek debris basin is located at the wildland urban interface. Tiger salamanders may be present on grazing lands upslope from debris basin. BMP 3.1 will be used to determine presence of tiger salamanders prior to any work being conducted. If salamanders are found on-site alternative non-impactive methods of clearing site or a change in timing of work will be investigated.	1	Upland Herbicide Mechanical/ Mowing
Silver Creek Hills Habitat and Population	Upper Silver Creek	No Impact	Tiger salamanders do not use in-stream environments. Creek is located in urban environment bordered by houses and streets	0.7	Sediment Removal
	Upper Silver Creek	No Impact	Tiger salamanders do not use in-stream environments. Creek is located in urban environment bordered by houses and streets	0.6	Aquatic Herbicide
	Silver Creek Diversion	No Impact	Creek is concrete lined channel with gravel access road located in urban environment with houses, streets and US 101 bordering creek	0.3	Herbicide Application Hand
	Silver Creek Diversion	No Impact	Creek is concrete lined channel with gravel access road located in urban environment with houses, streets and US 101 bordering creek	9.0	Herbicide Application Mechanical
	Silver Creek Diversion	No Impact	Creek is concrete lined channel with gravel access road located in urban environment with houses, streets and US 101 bordering creek	0.8	Overhang-ing Growth

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Thompson Creek	No Impact	Tiger salamanders do not use in-stream environments. Channel is in urban environment with levees and modified floodplain.	1.6	Sediment Removal
	Thompson Creek	No Impact	Tiger salamanders do not use in-stream environments. Channel is in urban environment with levees and modified floodplain.	6.2	Aquatic Herbicide
	Thompson Creek	No Impact	Tiger salamanders do not use in-stream environments. Channel is located in urban environment with levees and modified floodplain.	1.0	In Channel Hand Removal
	Thompson Creek	No Impact	Creek is located in urban environment with levees and modified floodplain. Streets, and houses border the creek	32.0	Discing
	Thompson Creek	No Impact	Creek is located in urban environment with streets, houses and shopping centers bordering the creek	2.5	Upland Herbicide Hand Application
	Thompson Creek	No Impact	Creek is located in urban environment with streets, houses and shopping centers bordering the creek	14.4	Upland Herbicide Mechanical Application
	Thompson Creek	No Impact	Creek is located in urban environment with streets, houses and shopping centers bordering the creek	8.3	Upland Herbicide Selective Mechanical
	Thompson Creek	No Impact	Creek is located in urban environment with streets, houses and shopping centers bordering the creek	10.4	Mowing
	Thompson Creek	No Impact	Work type does not affect tiger salamanders	0.3	Overhanging Growth

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Quimby Creek	No Impact	Tiger salamanders do not use in-stream environments. Area is located in urban environment. With houses streets and schools bordering the creek.	0.8	Aquatic Herbicide
	Quimby Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	11.3	Upland Herbicide Mechanical
	Quimby Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	4.8	Mowing
	Quimby Creek	No Impact	Work type does not affect tiger salamanders	0.3	Overhanging Growth
	Quimby Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	0.3	Upland Herbicide Mechanical
	Quimby Creek	No Impact	Area is located in urban environment. With houses streets and schools bordering the creek.	0.5	Mowing
Santa Teresa Hills/Calero Population	Fisher Creek	No Impact	Tiger salamanders do not use in-stream environments.	0.2	Sediment Removal
	Fisher Creek	No Impact	Tiger salamanders do not use in-stream environments.	0.3	Aquatic Herbicide
	Fisher Creek	No Impact	Fisher Creek runs through the west side of Coyote Valley. This section of Fisher Creek is bordered by houses and row crop agriculture.	1.8	Mowing

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Mt. Diablo Range Habitat Area	Llagas Creek	No Impact	The lower portion of Llagas Creek is located in the area known as Soap Lake. This area is used for row crop agriculture. Plowed fields border the levees on both sides of the creek. Work within the channel is prohibited because of the presence of Least Bell's Vireo. Vegetation work on levees and levee roads will continue.	1.3	Upland Herbicide Hand Application
	Llagas Creek	No Impact	The lower portion of Llagas Creek is located in the area known as Soap Lake. This area is used for row crop agriculture. Plowed fields border the levees on both sides of the creek. Work within the channel is prohibited because of the presence of Least Bell's Vireo. Vegetation work on levees and levee roads will continue.	9.9	Upland Herbicide Mechanical Application
	Llagas Creek	No Impact	The lower portion of Llagas Creek is located in the area known as Soap Lake. This area is used for row crop agriculture. Plowed fields border the levees on both sides of the creek. Work within the channel is prohibited because of the presence of Least Bell's Vireo. Vegetation work on levees and levee roads will continue.	14.4	Selective Upland Herbicide Mechanical Application

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Llagas Creek	No Impact	The lower portion of Llagas Creek is located in the area known as Soap Lake. This area is used for row crop agriculture. Plowed fields border the levees on both sides of the creek. Work within the channel is prohibited because of the presence of Least Bell's Vireo. Vegetation work on levees and levee roads will continue.	9.9	Mowing
Santa Cruz Mountains Habitat Area	Llagas Creek	No Impact	Tiger salamanders do not use in-stream environments.	9.9 acres in reach only 0.9 active work area	In channel hand removal
	Llagas Creek	No Impact	Tiger salamanders do not use in-stream environments.	8.6	In channel hand removal
	Llagas Creek	No Impact	Tiger salamanders do not use in-stream environments.	25.2 acres in reach only 0.9 active work area	In channel hand removal
	Edmundson Creek	No Impact	Tiger salamanders do not use in-stream environments.	0.3	Aquatic Herbicide
	Edmundson Creek	No Impact	Portion of creek is located in urbanized section of Morgan Hill. Houses and streets border the creek.	0.2	Upland Herbicide Hand Application
	Lions Creek	No Impact	Tiger salamanders do not use in-stream environments.	0.07	Aquatic Herbicide

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Lions Creek	No Impact	Lions Creek is located in a rural area west of Gilroy. Current land uses are primarily cattle grazing. Several ponds are located within migration distance of tiger salamanders. BMP 3.1 will be used to determine presence of tiger salamanders before any work is initiated. If tiger salamanders are found alternative nonimpactive methods of clearing site or a change in timing of work will be investigated.	0.02	Upland Herbicide Mechanical Application
	Lions Creek	No Impact	Lions Creek is located in a rural area west of Gilroy. Current land uses are primarily cattle grazing. Several ponds are located within migration distance of tiger salamanders BMP 3.1 will be used to determine presence of tiger salamanders before any work is initiated. If tiger salamanders are found alternative nonimpactive methods of clearing site or a change in timing of work will be investigated.	0.25	Upland Herbicide Hand Application
	Lions Creek	No Impact	Lions Creek is located in a rural area west of Gilroy. Current land uses are primarily cattle grazing. Several ponds are located within migration distance of tiger salamanders. BMP 3.1 will be used to determine presence of tiger salamanders before any work is initiated. If tiger salamanders are found alternative nonimpactive methods of clearing site or a change in timing of work will be investigated.	0.02	Mowing

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
Mt Diablo Range Habitat Area	Jones Creek	No Impact	Tiger salamanders do not use in-stream environments.	2.6	Sediment Removal
	Jones Creek	No Impact	Tiger salamanders do not use in-stream environments.	0.3	Aquatic Herbicide
West Gilroy Population	Uvas-Carnadero Creek	No Impact	Tiger salamanders do not use in-stream environments.	34.0	Aquatic Herbicide
	Uvas Creek	No Impact	Site is located on the northeast side of the creek. The adjacent land is urban development within the City of Gilroy.	1.5	Discing
	Uvas Creek	No Impact	Site is located on the northeast side of the creek. The adjacent land is urban development within the City of Gilroy.	1.5	Upland Herbicide Mechanical Application
	Uvas Creek	No Impact	Site is located on the northeast side of the creek. The adjacent land is urban development within the City of Gilroy.	2.0	Upland Selective Herbicide Mechanical Application
	Uvas Creek	No Impact	Site is located on the northeast side of the creek. The adjacent land is urban development within the City of Gilroy.	5.8	Mowing
Silver Creek Hills Population	Coyote Creek	No Impact	Creek is located in urban area. Immediately north of Hellyer Park. Houses border creek area. No ponds in vicinity.	0.8	Upland Herbicide Mechanical Application
West Gilroy Population	Princevalle Drain	No Impact	Tiger salamanders do not use in-stream environments.	3.8	Aquatic Herbicide
	Princevalle Drain	No Impact	Weed abatement area is located west of U.S. Highway 101 in urban area of Gilroy	1.3	Weed Abatement

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Princevalle Drain	No Impact	Area west of U.S. Highway 101 is urbanized making site unsuitable for tiger salamanders Area east of U.S. Highway 101 is bordered by intensive row crop agriculture make site unsuitable for tiger salamanders	9.0	Upland Herbicide Mechanical Application
	Princevalle Drain	No Impact	Spray area is located west of U.S. Highway 101 in urban portion of Gilroy	0.8	Upland Herbicide Hand Application
	Princevalle Drain	No Impact	Area west of U.S. Highway 101 is urbanized making site unsuitable for tiger salamanders Area east of U.S. Highway 101 is bordered by intensive row crop agriculture make site unsuitable for tiger salamanders	9.0	Mowing Open Areas
	Princevalle Drain	No Impact	Area west of U.S. Highway 101 is urbanized making site unsuitable for tiger salamanders Area east of U.S. Highway 101 is bordered by intensive row crop agriculture make site unsuitable for tiger salamanders	2.3	Mowing Slopes
	Princevalle Drain	No Impact	Work type does not affect tiger salamanders	0.3	Overhanging Growth
Mt. Diablo Habitat Area	Coyote Canal	No Impact	Tiger salamanders do not use in-stream environments.	7.0	Aquatic Herbicide
	Coyote Canal	No Impact	Approximately 4 miles located east of U.S. Highway 101 in Bay Checkerspot Critical Habitat no spray areas. 3 miles located west of U.S. Highway 101 and subject to spraying. BMP 3.1 will be used to identify tiger salamander use of the site. Work site is existing road surface only.	16.3 Approx, 6.9 acres in spray area.	Upland Herbicide Mechanical Application

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Coyote Canal Extension	No Impact	Tiger salamanders do not use in-stream environments.	2.1	Aquatic Herbicide
Santa Teresa Hills Habitat	Coyote Alamitos Canal	No Impact	Tiger salamanders do not use in-stream environments.	1.2	Aquatic Herbicide
	Coyote Alamitos Canal	No Impact	Tiger salamanders do not use in-stream environments.	0.3	Aquatic Herbicide
	Coyote Alamitos Canal	No Impact	Tiger salamanders do not use in-stream environments.	0.1	Aquatic Herbicide
	Coyote Alamitos Canal	No Impact	Discing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMPs 3.1, 3.3, and 3.19 will be employed.	2.7	Discing
	Coyote Alamitos Canal	No Impact	Discing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMPs 3.1, 3.3, and 3.19 will be employed.	0.6	Discing
	Coyote Alamitos Canal	No Impact	Discing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMPs 3.1, 3.3, and 3.19 will be employed	0.1	Discing
	Coyote Alamitos Canal	No Impcat	Hand removal of weeds occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMPs 3.1, 3.3, and 3.19 will be employed.	0.8	Weed Abatement Hand

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Coyote Alamitos Canal	No Impact	Hand removal of weeds occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed.	0.2	Weed Abatement Hand
	Coyote Alamitos Canal	No Impact	Hand removal of weeds occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed.	0.0	Weed Abatement Hand
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed	4.0	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed	0.9	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed	0.2	Upland Herbicide Mechanical Application

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	Work Area	Potential Impact	Issue Discussion	Acres of Overlap	Type of Activity
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1 and 3.3 will be employed	3.2	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed	0.7	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Upland herbicide use occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. BMP 3.1, 3.3, and 3.19 will be employed	0.2	Upland Herbicide Mechanical Application
	Coyote Alamitos Canal	No Impact	Mowing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. In Serpentine areas mowing does not occur until after the end of the growing season. BMP 3.1 and 3.3 will be employed	0.8	Mowing
	Coyote Alamitos Canal	No Impact	Mowing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. In Serpentine areas mowing does not occur until after the end of the growing season	0.2	Mowing

TABLE 10
Potential Effects on California Tiger Salamanders
(Continued)

Population/ Location	**Work Area**	**Potential Impact**	**Issue Discussion**	**Acres of Overlap**	**Type of Activity**
	Coyote Alamitos Canal	No Impact	Mowing occurs downslope of canal adjacent to urban development. Tiger salamanders, if present, would have to cross the steep sided and concrete lined canal. In Serpentine areas mowing does not occur until after the end of the growing season	0.0	Mowing
Calero Population and Potential Habitat	Almaden Calero Canal	No Impact	Tiger salamanders do not use in-stream environments.	3.0	Aquatic Herbicide
	Almaden Calero Canal	No Impact	Areas within butterfly habitat areas and areas with sensitive serpentine plants will not be sprayed (BMP 3.3). Work is limited to road surface only. BMP 3.1 will be used prior to application of herbicides.	1.4	Upland Herbicide Hand Application
	Almaden Calero Canal	No Impact	Areas within butterfly habitat areas and areas with sensitive serpentine plants will not be sprayed (BMP 3.3). Work is limited to road surface only. BMP 3.1 will be used prior to application of herbicides.	14.4	Upland Herbicide Mechanical Application

TABLE 11
Channel Maintenance Activities Occurring in Different Fish Habitat Types in Santa Clara Basin and Pajaro River Basins

Fish habitat type provided in miles and percent of total miles for each habitat type

Fish Habitat		**Sediment Removal**				**Channel Vegetation Management**				
Type	**Habitat**	**Santa Clara**		**Pajaro River**		**Santa Clara**		**Pajaro River**		**Total**
	Key	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**
No Value (0)	NV	3.8	8.2	4.7	33.8	6.7	3.8	14.9	25.4	30.1
Fish Scare (1)	FS	15.3	32.8	1.4	10.2	52.8	30.3	11.3	19.2	80.8
Mixed Native (2)	MN	10.8	23.0	4.9	35.5	30.1	17.3	9.9	17.0	55.7
Mixed Naive Spawning (3)	MN-S	1.7	3.7	0.0	0.0	20.1	11.5	0.0	0.0	21.8
Warm Water Native (4)	WW-N	0.5	1.1	0.0	0.0	5.4	3.1	3.8	6.5	9.7
Potential Trout (5)	WW-T	0.2	0.5	0.0	0.0	17.0	9.7	8.5	14.5	25.7
Cold Water Steelhead (6)	CW-S	0.1	0.2	0.0	0.0	4.1	2.4	5.4	9.3	9.7
Cold Water Trout (7)	CW-T	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.4
No Habitat Category Data	NDD	14.2	30.5	2.8	20.5	37.7	21.6	4.8	8.2	59.6
	Totals	46.7	100	13.9	100	174.3	100	58.6	100	293.5

Note: Stream reaches with Sediment Removal activities may also contain Channel Vegetation Management activities, and vice versa. Actual work in the Pajaro River Basin will be less than indicated here since channel work on 10 miles of the Pajaro River and Llagas Creek downstream of Highway 152 has subsequently been deleted from the SMP.

TABLE 12
Summary of In-Channel Vegetation Impacts in Acres

Work Activity	Stream Vegetation Impacts		
	Freshwater Wetlands	**Tidal Wetlands**	**Riparian Vegetation**
Santa Clara Basin Streams			
Sediment Removal	61	29	0
Vegetation Management	23	1	32
Santa Clara Basin Total	84	30	32
Pajaro River Basin Streams			
Sediment Removal	11	0	0
Vegetation Management	4	0	34
Pajaro River Basin Total	15	0	34
District Streams Total	99	30	66
Canals			
Sediment Removal	n/a	n/a	n/a
Vegetation Management	7	0	0
Canals Total	7	0	0
Total SMP	**106**	**30**	**66**

Source: District 8/01

Note: Impact projections from vegetation management represent sections of creek where only channel vegetation management work is undertaken.

TABLE 13
Other Future District Projects in Creeks

Project Name Location Activity	Construction Dates
Adobe Reaches 1-5, 7-9, 11-13 flood protection, bank protection	2003 - 2007
Matadero/Barron Creek Remediation Palo Alto Flood Basin - Foothill Expressway flood protection	2003-2008
Permanente Creek San Francisco Bay - Foothill Expressway flood protection	2009-2016
San Francisquito Creek San Francisco Bay to Searsville Dam flood protection	2006-2009
San Francisquito Creek downstream of Hwy 101 restore existing levee	2002-2003
Stevens Creek Drop Structure Modifications upstream of Highway 85 fish passage	2002-2003
Sunnyvale West Channel Guadalupe Slough to Hwy 101 flood protection	2011-2012
Sunnyvale East Channel Guadalupe Slough to Interstate 280 flood protection	2014-2016
Calabazas Creek Miller Avenue to Wardell Road flood protection	2012-2014
Calabazas Creek Lawrence Expressway to Miller Avenue revegetation	2002-2004
Calabazas Creek Bollinger Bridge enlargement of existing bridge	2002-2003
San Tomas Creek Repairs Monroe Street to Williams Road repair of reinforced box culvert	unknown
Calabazas Creek Comber Debris Basin removal of debris basin	unknown

Table 13
Other Future District Projects in Creeks
(Continued)

Project Name **Location** **Activity**	**Construction Dates**
Lower Guadalupe River Union Pacific Railroad to Interstate 880 flood protection	2003-2005
Downtown Guadalupe River Highway 880 - Highway 280 flood protection	2002-2006
Guadalupe Creek Restoration Almaden Expressway to Masson Dam creek restoration	2002
Upper Guadalupe River flood protection	2002-2007, 2012-2016
Los Gatos Creek Erosion Repairs Central Pipeline bank protection	2002
Los Gatos Creek Bank Stabilization Guadalupe River to Camden Avenue bank protection	2004-2005
Randol Creek Flood Risk Study	unknown
Los Gatos Creek at Gilgan Lincoln Avenue to Meridian Avenue bank protection	2004
Berryessa Creek Lower Penitencia to Piedmont Avenue flood protection	2003-2007
Calera Creek Berryessa Creek to Hwy 680 flood protection	unknown
Calera Creek at Union Pacific Railroad flood protection	2002
Coyote Creek Montague Expressway to Hwy 208 flood protection	2014-2016
Coyote Creek Outdoor Classroom bank protection, revegetation	2002
Coyote Creek South Bay Mobile Home Park flood wall	2002

Table 13
Other Future District Projects in Creeks
(Continued)

Project Name Location Activity	Construction Dates
Coyote Creek Rock Spring neighborhood flood protection	2005
Lower Silver Creek Reaches 1-6 flood protection	2002-2009
Silver/Thompson Creek Cunningham to Quimby Road, Lake Cunningham flood protection	2002
Upper Penitencia Creek Coyote Creek to King Road flood protection	2002-2004, 2007-2010
Lower Llagas Creek, Church Ponds Pajaro River to Buena Vista Avenue flood protection, environmental cleanup	2002-2007
South Zone Buffer Strips revegetation	2003-2005
Upper Llagas Creek Buena Vista Road and Wright Avenue flood protection	2002-2007

TABLE 14
Definition of Alternatives

Alternative	Amount of Work (extent of channel maintenance)	Initial Impacts to Stream Vegetation	Herbicide Use in Santa Clara Basin	Herbicide Use in Pajaro Basin
1. **Multi-Year Program**	*Sediment removal* 58 miles Channel veg. management 246 miles	Freshwater Wetlands 108 acres Tidal Wetlands 30 acres Riparian Vegetation 67 acres	Yes	Yes
2. ***Existing Program***	Sediment removal 58 miles Channel veg. management 246 miles	Freshwater Wetlands 108 acres Tidal Wetlands 30 acres Riparian Vegetation 67 acres	Yes	No
3. **No Work**	Sediment removal 0 miles Channel veg. management 0 miles	None	No	No
4. **No Herbicides**	Sediment removal 58 miles Channel veg. management 246 miles	Freshwater Wetlands 106 acres Tidal Wetlands 30 acres Riparian Vegetation 66 acres	No	No
5. **Modified Pajaro River Basin (Preferred)**	Sediment removal 58 miles Channel veg. management 246 miles	Freshwater Wetlands 106 acres Tidal Wetlands 30 acres Riparian Vegetation 66 acres	Yes	No in channels, Yes in uplands
6. **Reduced Work**	Sediment removal 55 miles Channel veg. management 142 miles	Freshwater Wetlands 105 acres *Tidal Wetlands* 30 acres Riparian Vegetation 39 acres	Yes, less than SMP	Yes, less than SMP

TABLE 15
Cost Comparison of Alternatives

WORK TYPE AND LOCATION	1. MODIFIED PAJARO RIVER BASIN ALTERNATIVE (Preferred Alternative)		2. MULTI-YEAR ALTERNATIVE		3. NO PROGRAM (EXISTING)		4. NO WORK ALTERNATIVE		5. NO HERBICIDE ALTERNATIVE		6. REDUCED WORK ALTERNATIVE	
	Annual Cost ($)	20-Year Cost ($)	Annual Cost ($)	20-Year Cost ($)	Annual Cost ($)	20-Year Cost ($)	Annual Cost ($)	20-Year Cost ($)	Annual Cost ($)	20-Year Cost ($)	Annual Cost ($)	20-Year Cost ($)
Santa Clara Basin												
Sediment Removal	$2,766,000	$55,320,000	$2,766,000	$55,320,000	$2,766,000	$55,320,000	$0	$0	$2,766,000	$55,320,000	$2,729,000	$54,580,000
Vegetation Management	$941,000	$18,820,000	$941,000	$18,820,000	$941,000	$18,820,000	$0	$0	$5,316,000	$106,320,000	$625,000	$12,500,0
Total	$3,707,000	$74,140,000	$3,707,000	$74,140,000	$3,707,000	$74,140,000	$0	$0	$8,082,000	$161,640,000	$3,354,000	$67,080,0
Pajaro Basin												
Sediment Removal	$248,000	$4,960,000	$248,000	$4,960,000	$248,000	$4,960,000	$0	$0	$248,000	$4,960,000	$128,000	$2,560,0
Vegetation Management	$515,000	$10,300,000	$308,000	$6,160,000	$915,000	$18,300,000	$0	$0	$915,000	$18,300,000	$233,000	$4,660,0
Total	$763,000	$15,260,000	$556,000	$11,120,000	$1,163,000	$23,260,000	$0	$0	$1,163,000	$23,260,000	$361,000	$7,220,000
Bank Protection												
Repair Work	$3,780,000	$75,600,000	$3,780,000	$75,600,000	$3,780,000	$75,600,000	$0	$0	$3,780,000	$75,600,000	$1,890,000	$37,800,0
Mitigation	$695,000	$13,900,000	$695,000	$13,900,000	$695,000	$13,900,000	$0	$0	$695,000	$13,900,000	$347,500	$6,950,0
Total	$4,475,000	$89,500,000	$4,475,000	$89,500,000	$4,475,000	$89,500,000			$4,475,000	$89,500,000	$2,237,500	$44,750,000
Levee Maintenance	$1,590,000	$31,800,000	$1,590,000	$31,800,000	$1,590,000	$31,800,000	$0	$0	$1,590,000	$31,800,000	$1,590,000	$31,800,0
Debris and Obstruction Removal	$3,170,000	$63,400,000	$3,170,000	$63,400,000	$3,170,000	$63,400,000	$0	$0	$3,170,000	$63,400,000	$3,170,000	$63,400,000
Canals	$52,000	$1,040,000	$52,000	$1,040,000	$52,000	$1,040,000	$0	$0	$79,000	$1,580,000	$52,000	$1,040,0
Mitigation												
Tidal Wetland Restoration	$110,000	$2,200,000	$110,000	$2,200,000	$110,000	$2,200,000			$110,000	$2,200,000	assumes overall reduction approx. 20% in mitigation costs	
Freshwater Wetland Creation	$470,000	$9,400,000	$470,000	$9,400,000	$470,000	$9,400,000			$470,000	$9,400,000		
Stream & Watershed Protection	$945,000	$18,900,000	$1,020,000	$20,400,000	$945,000	$18,900,000			$945,000	$18,900,000		
Giant Reed Control	$295,000	$5,900,000	$295,000	$5,900,000	$295,000	$5,900,000			$295,000	$5,900,000		
Endangered Species Surveying & Monitoring	$250,000	$5,000,000	$250,000	$5,000,000	$250,000	$5,000,000			$250,000	$5,000,000		
Total	$2,070,000	$41,400,000	$2,145,000	$42,900,000	$2,070,000	$41,400,000	$0	$0	$2,070,000	$41,400,000	$1,720,000	$34,400,0
ALTERNATIVE TOTAL	$15,827,000	$316,540,000	$15,695,000	$313,900,000	$16,227,000	$324,540,000	$0	$0	$20,629,000	$412,580,000	$12,484,500	$249,690,0

TABLE 16
Potential Flooding Area Under the No Work Alternative

Land Use	Number of Parcels	Acres
Residential	77,262	11,900
High-density residential	2,733	1,612
Public	432	674
Commercial	2,624	3,206
Industrial	1,796	6,158
Agricultural	358	4,574
Vacant and open space	1,560	3,521
Total	**86,765**	**31,645**

Source: Information from the District's GIS/WWMM dated March 20, 2001

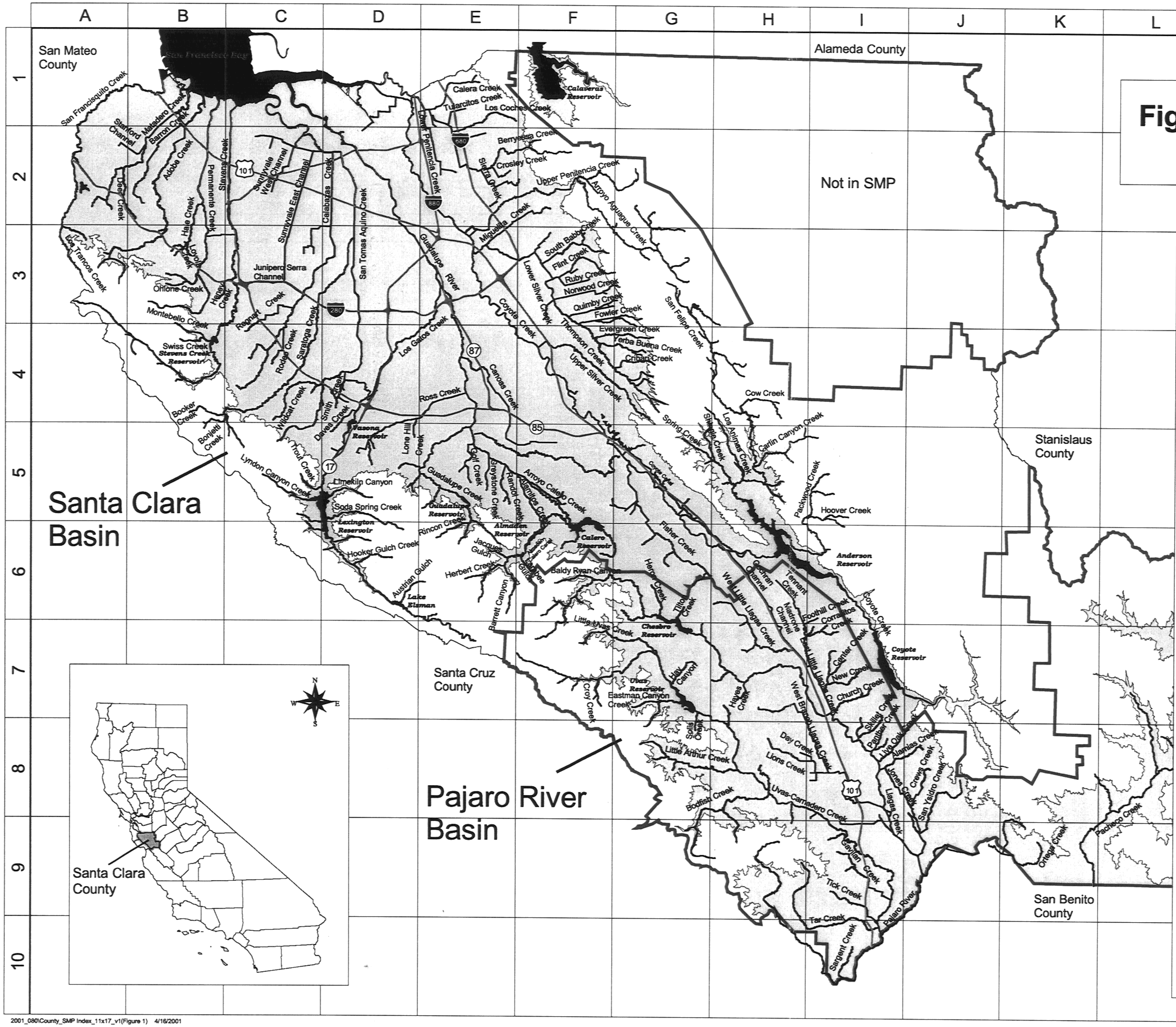
TABLE 17
Alternatives Comparison of Initial and Long-Term Stream Vegetation Impacts

	Impacts to Stream Vegetation From Sediment Removal and Vegetation Management (acres)					
	Initial Impacts			Long-Term Impacts		
	Freshwater Wetlands	Tidal Wetlands	Riparian Vegetation	Freshwater Wetlands	Tidal Wetlands	Riparian Vegetation
1. Multi-Year Program	108	30	67	108	30	67
2. Existing Program	108	30	67	108	30	67
3. No Work	0	0	0	0	0	0
4. No Herbicides	106	30	66	125	31	97
5. Modified Pajaro River Basin (Preferred)	106	30	66	106	30	66
6. Reduced Work	105	30	39	103	30	38

Source: District 8/01

Figures

Figure 1: Streams and Canals in District Jurisdiction



Creek Id	Name	Map Location	Creek Id	Name	Map Location
1010	Adobe	B1,B2,B3,A3	4025	Los Coches	E1,E2
5029	Alamias	I8,I7,J8	4026	Lower Silver	E3,F3
1037	Arastradero	A2,A3	4033	Lower Penitencia	D1,E2
4011	Arroyo Aguague	F2,F3,G3	1018	Loyola	B3
3037	Austrian Gulch	D6	3031	Lyndon Canyon	C5
7001	Baldy Ryan Canyon	F6	1021	Matadero	B1,B2
3038	Barrett Canyon	E6	4029	Miguelita	E2,E3,F2
1012	Barron	B2	1022	Montebello	B3,B4
4017	Berryessa	E1,E2,F2	5041	New	H7,I7
5049	Bodfish	H8,G8,G9	4042	Norwood	F3,G3
2012	Bonjetti	C4,B4,B5	1026	Ohlone	B3
2011	Booker	B4	5059	Ortega	K9
2010	Calabazas	D2,D3,C3,C4	5019	Pacheco	L8,L9,M8
4018	Calera	E1	5016	Pajaro	H10,I9,I10
3012	Calero	E5,F5	1039	Palo Alto Flood Basin	B1
3011	Canoas	E4,E5,F5	5042	Panther	I7,I8
7003	Carlin Canyon	H5,I5	1024	Permanente	B1,B2,B3,C1
5032	Center	H7,I7	2036	Prospect	C4
5034	Church	H7,I7	4043	Quimby	F3,G3
5021	Corralitos	H6,I6	3029	Randol	E5
4021	Coyote	D1,D2,E2,E3	2017	Regnart	C3,C4
5014	Crew	I8,J8	2018	Rodeo	C4
4036	Cribari	F4,G4	3023	Ross	D4,D5,E4
4041	Crosley	E2	4019	Ruby	F3
5001	Croy	F7	4053	San Felipe	G3,H4
2033	Daves	D4,D5	1028	San Francisquito	A2,B1,B2
5035	Day	H8,H7	5045	San Ysidro	I8,J8
1034	Deer	B2,B3	2019	San Tomas Aquino	D2,D3,D4
5037	East Little Llagas	H7	2021	Saratoga	C3,C4,D3
4045	Evergreen	F4,G4	5020	Sargent	I10
4023	Fisher	F5,G5,G6	4052	Shingle	H5,I5
4048	Flint	F3,G3	4037	Sierra	E2
5023	Foothill	H6	5047	Skilllet	I7
4044	Fowler	F3,G3	2023	Smith	D4
5026	Gavilan	I9	3046	Soda Spring	D5,D6
3013	Golf	E5	5063	Solis	G7
3014	Greystone	E5	4027	Spring	G5,H5
3026	Guadalupe Creek	C1,D1,D2,D3	1038	Stanford	B2
3015	Guadalupe River	E4,E5,D5	1029	Stevens	C1,C2,C3
1016	Hale	B2,B3	2026	Sunnyvale East Ch	C2,C3
7008	Hay Canyon	G7	2027	Sunnyvale West Ch	C2
1017	Heney	C3	1032	Swiss	B4
3040	Herbert	E6	5055	Tar	H9,H10,I10
3016	Hooker Gulch	D6	5024	Tennant	H7,H6
7009	Hoover	I5	4047	Thompson	F3,F4,G4
3041	Jaques Gulch	E6	3037	Trout	C5
2013	Junipero Serra Ch	C3	4040	Tularcitos	E1
3042	Larrabee Gulch	E6,F6	4032	Upper Penitencia	E2,E3,F2,G2
3043	Limekiln Canyon	D5	4038	Upper Silver	F3,F4,G4
5039	Lions	H7,H8	5018	Uvas-Carnadero	E7,F7,G7,H7
5048	Little Arthur	G8,H8	5012	West Little Llagas	G6,H6,H7
5062	Little Uvas	F7,G7	5031	West Branch Llagas	H7,H8,I8
5040	Live Oak	I7,I8	2030	Wildcat	C4,C5
5010	Llagas	I7,I8,I9	4046	Yerba Buena	F4,G4
4051	Las Animas	H4,H5			
3019	Lone Hill	D4.D5	9245	Coyote Canal	H6,G5
3020	Los Gatos	D4,D5,E3	9272	Almaden-Calero Canal	F5,F6
			5013	Madrone Channel	H6,H7
			4056	Cochran Channel	G6,H6

Features

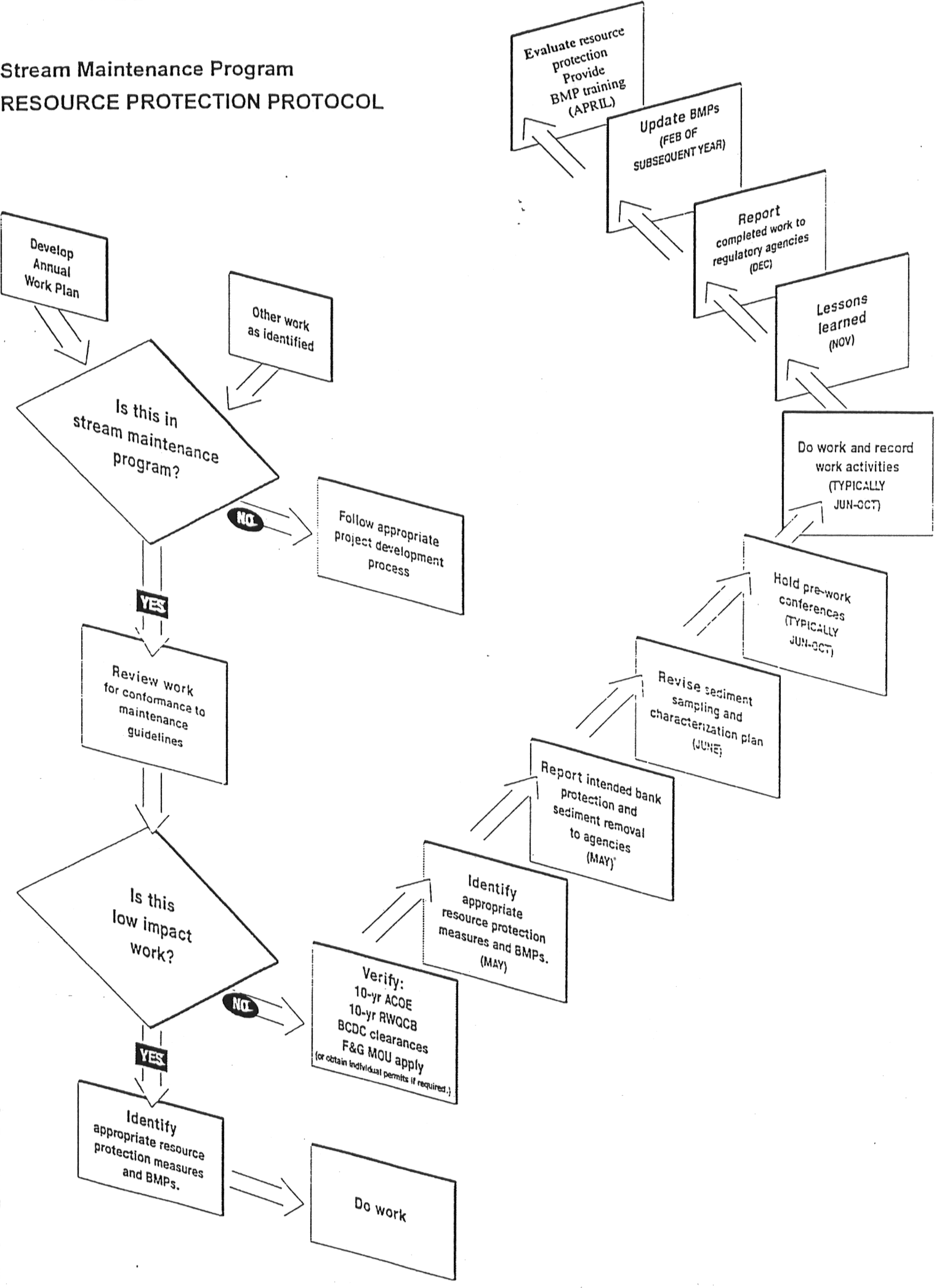
▭ Watershed Basins	╱╲╱ Creeks in District Jurisdiction
▭ 1000 Ft. Contour	╱╲╱ Roads
■ Lakes, Reservoirs, Ponds	

2 0 2 4 Miles

Santa Clara Valley Water District

FIGURE 2

Stream Maintenance Program
RESOURCE PROTECTION PROTOCOL


Develop Annual Work Plan
Other work as identified
Is this in stream maintenance program?
NO
Follow appropriate project development process
YES
Review work for conformance to maintenance guidelines
Is this low impact work?
NO
YES
Identify appropriate resource protection measures and BMPs.
Do work
Verify: 10-yr ACOE 10-yr RWQCB BCDC clearances F&G MOU apply (or obtain individual permits if required.)
Identify appropriate resource protection measures and BMPs. (MAY)
Report intended bank protection and sediment removal to agencies (MAY)
Revise sediment sampling and characterization plan (JUNE)
Hold pre-work conferences (TYPICALLY JUN-OCT)
Do work and record work activities (TYPICALLY JUN-OCT)
Lessons learned (NOV)
Report completed work to regulatory agencies (DEC)
Update BMPs (FEB OF SUBSEQUENT YEAR)
Evaluate resource protection Provide BMP training (APRIL)

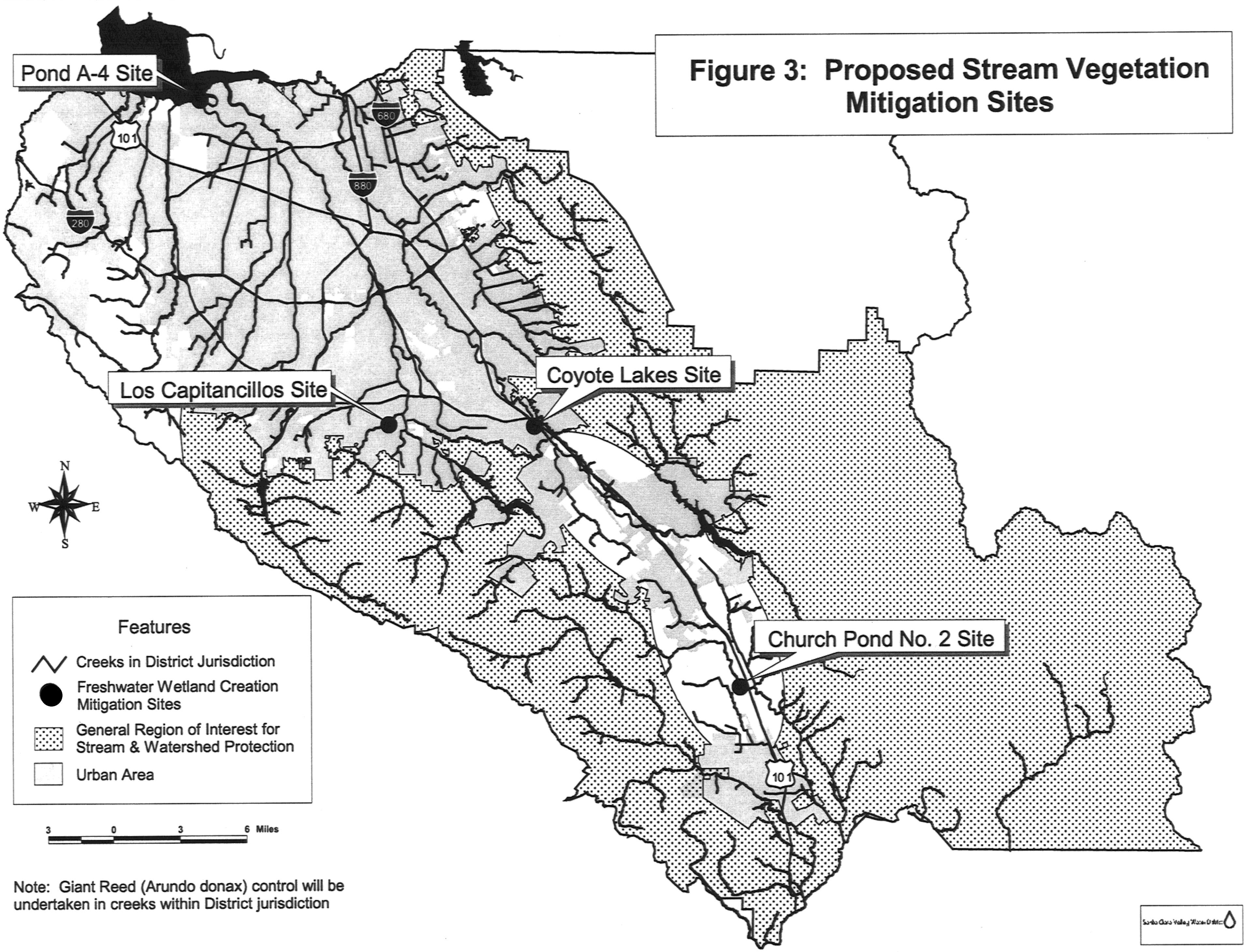


Figure 3: Proposed Stream Vegetation Mitigation Sites

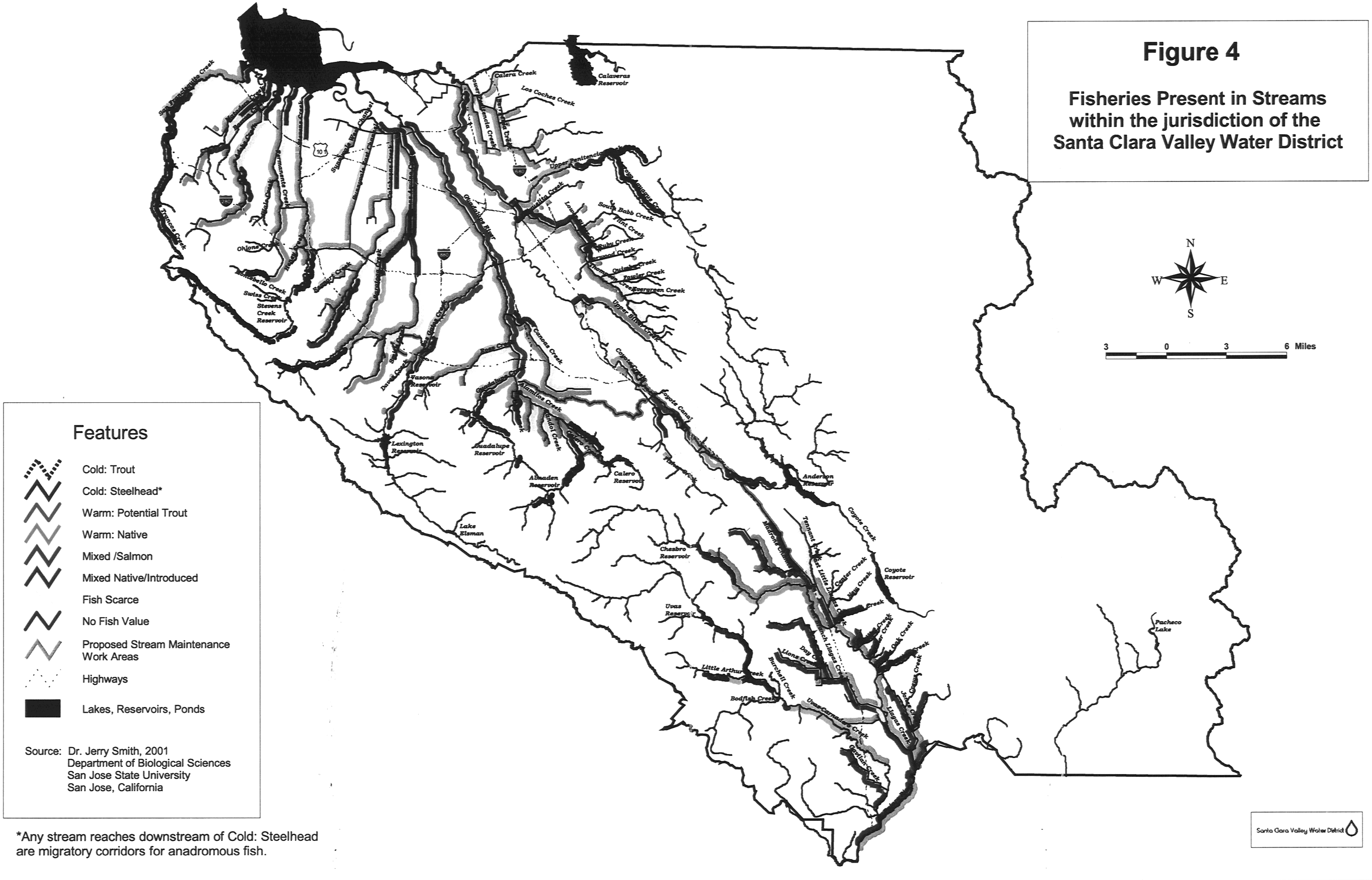
Pond A-4 Site
Los Capitancillos Site
Coyote Lakes Site
Church Pond No. 2 Site
101
680
880
280
N
S
E
W
Features
Creeks in District Jurisdiction
Freshwater Wetland Creation Mitigation Sites
General Region of Interest for Stream & Watershed Protection
Urban Area
3
0
3
6 Miles
Santa Clara Valley Water District

Note: Giant Reed (Arundo donax) control will be undertaken in creeks within District jurisdiction

09/20/2001 000407\2000_176\County_vegetation mitigation_8x11

Figure 4

Fisheries Present in Streams within the jurisdiction of the Santa Clara Valley Water District



Source: Dr. Jerry Smith, 2001
Department of Biological Sciences
San Jose State University
San Jose, California

*Any stream reaches downstream of Cold: Steelhead are migratory corridors for anadromous fish.

09/20/2001 000407\2001_080\County_TRA Fisheries Data _11x17 (Figure 4)

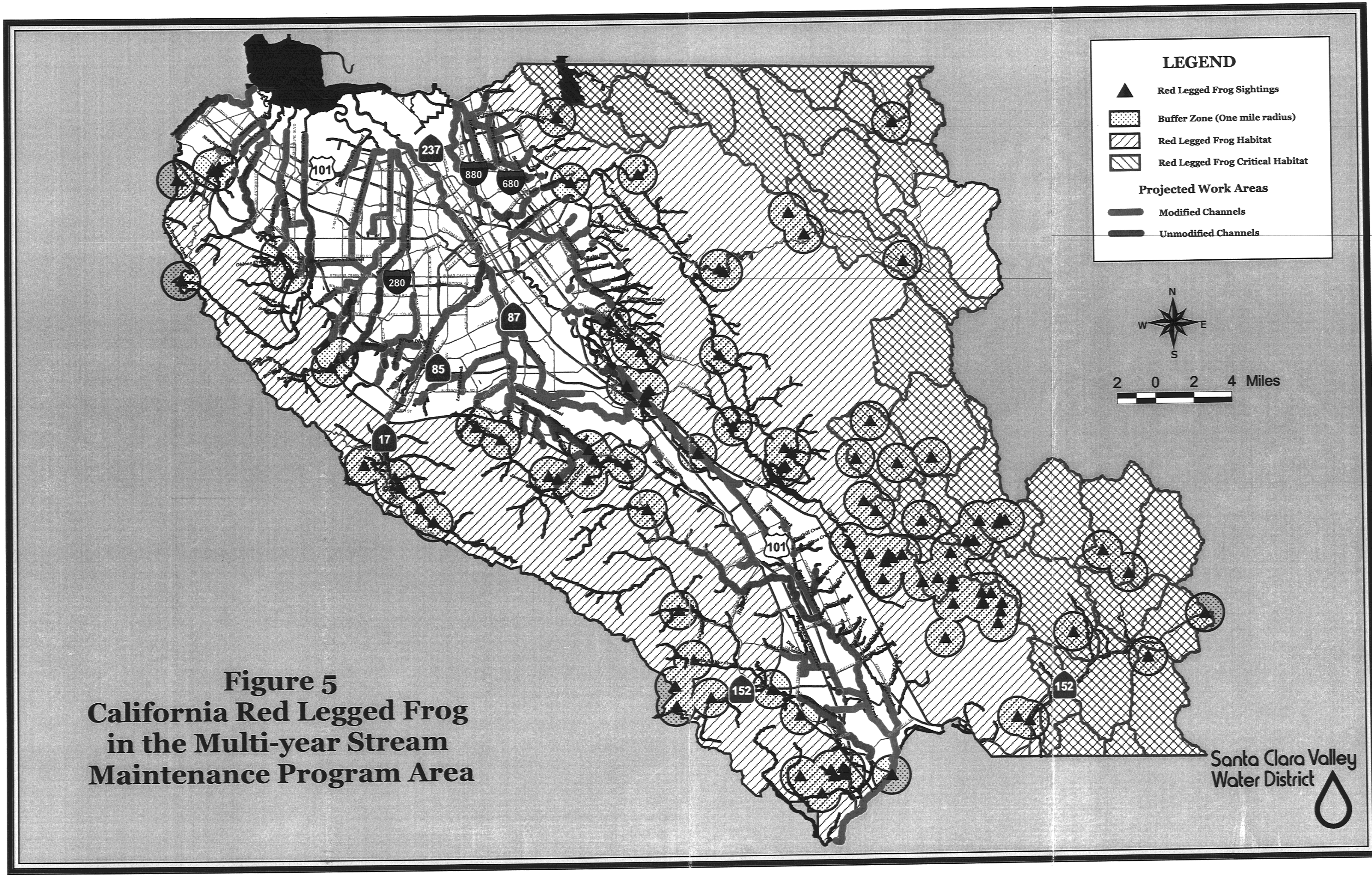


Figure 5
California Red Legged Frog in the Multi-year Stream Maintenance Program Area

000407\2001_138\L_red_leg_frog_11x17 Sept_12_2001

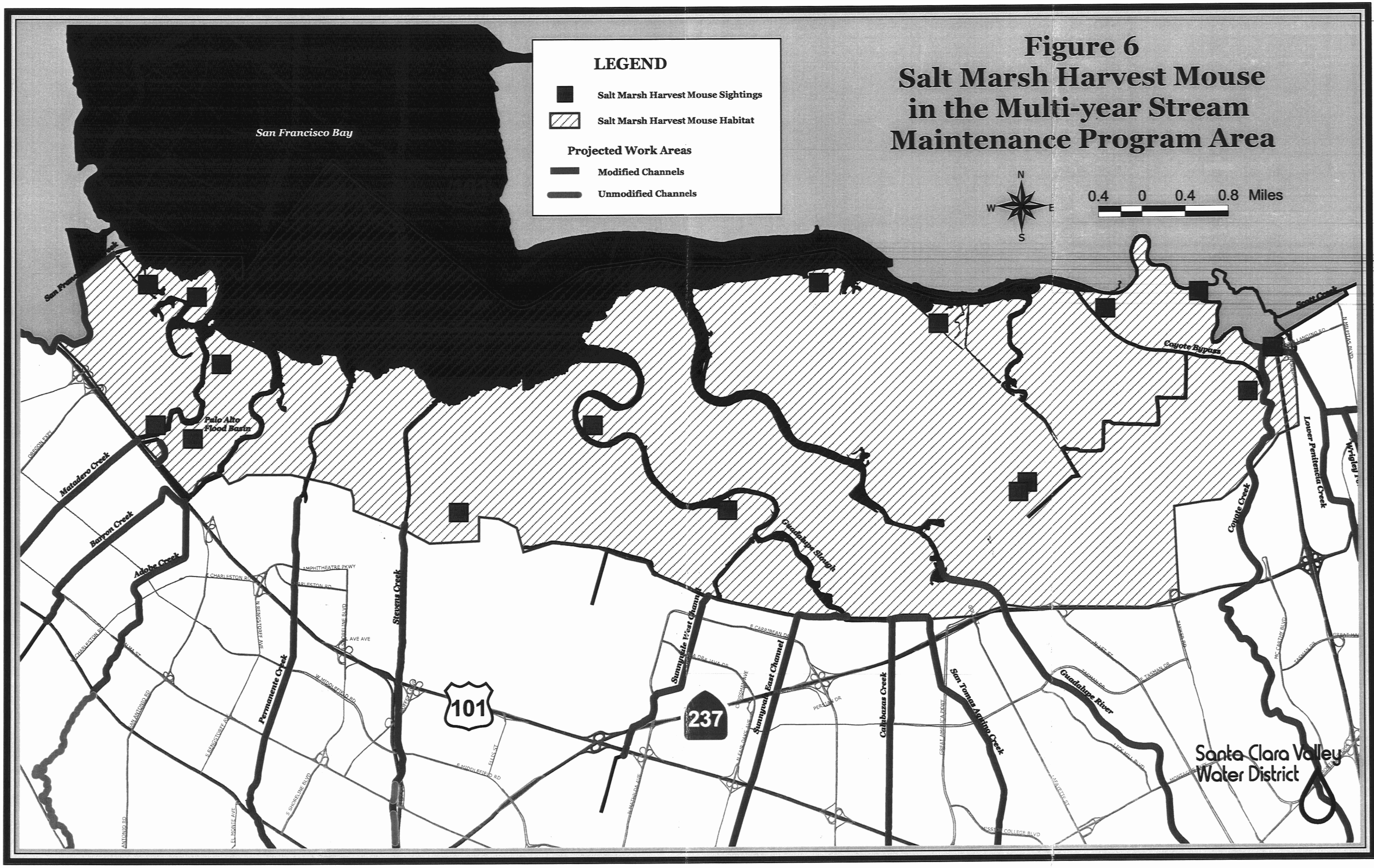
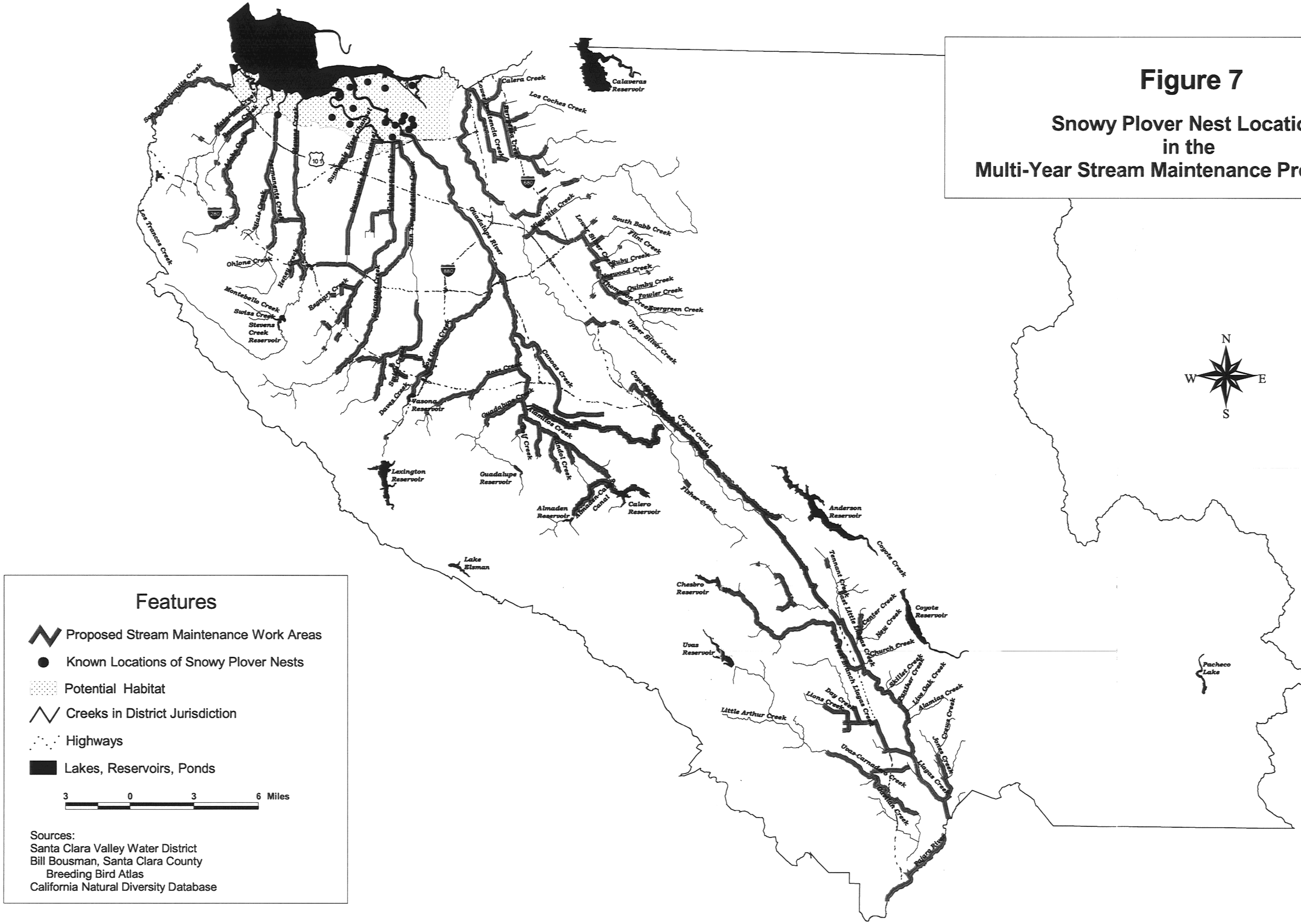


Figure 6
Salt Marsh Harvest Mouse in the Multi-year Stream Maintenance Program Area

000407\2001_138\L_detail_mouse_11x17 Sept_12_2001

Figure 7

Snowy Plover Nest Locations in the Multi-Year Stream Maintenance Program Area



Sources:
Santa Clara Valley Water District
Bill Bousman, Santa Clara County
Breeding Bird Atlas
California Natural Diversity Database

Santa Clara Valley Water District

04/20/2001 000407\2001_080\County_Snowy Plover Nests_11x17_v1 (Figure 7))

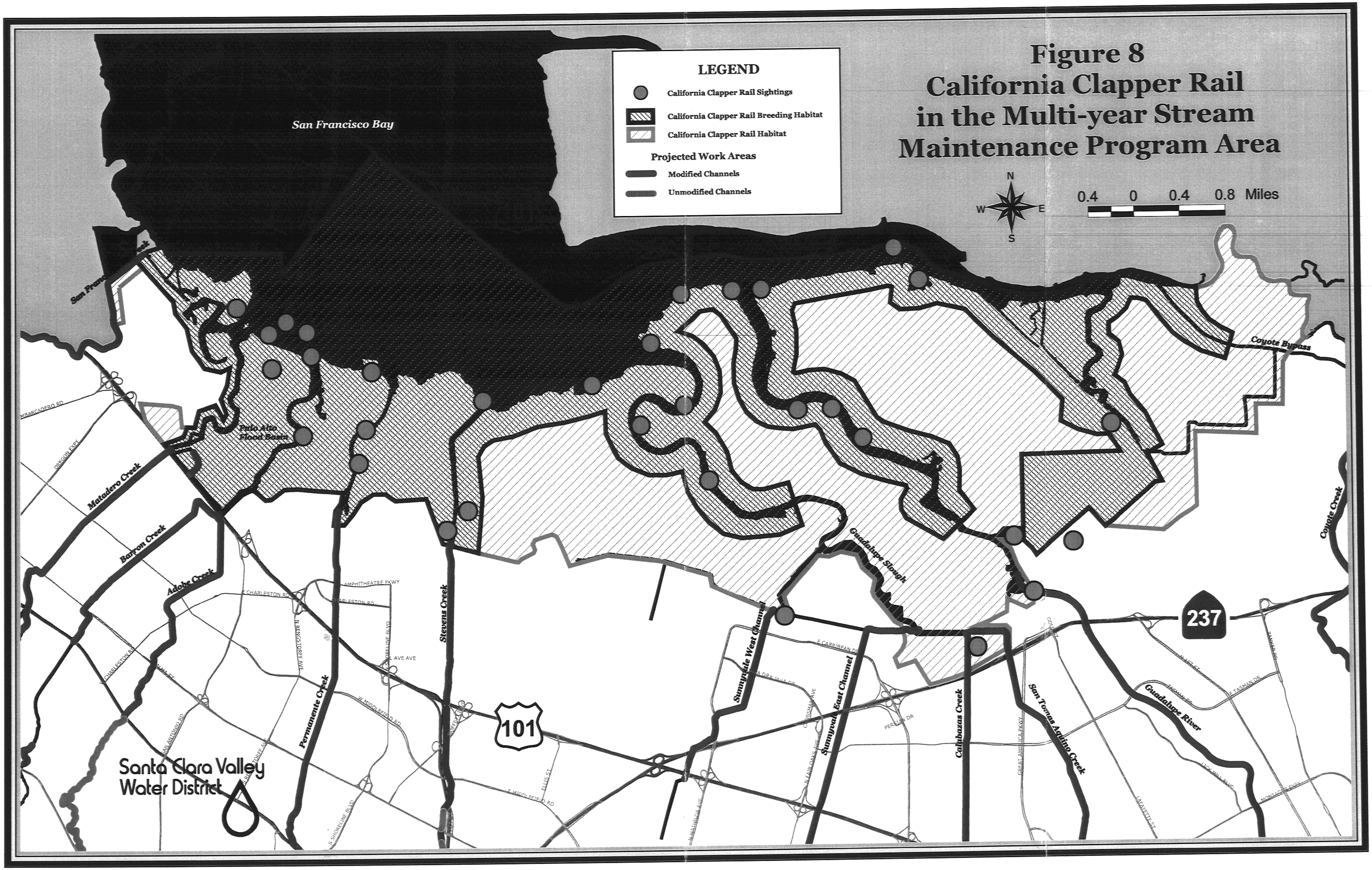


Figure 8
California Clapper Rail in the Multi-year Stream Maintenance Program Area

000407\2001_138\L_detail_ccrail_11x17 Sept_12_2001

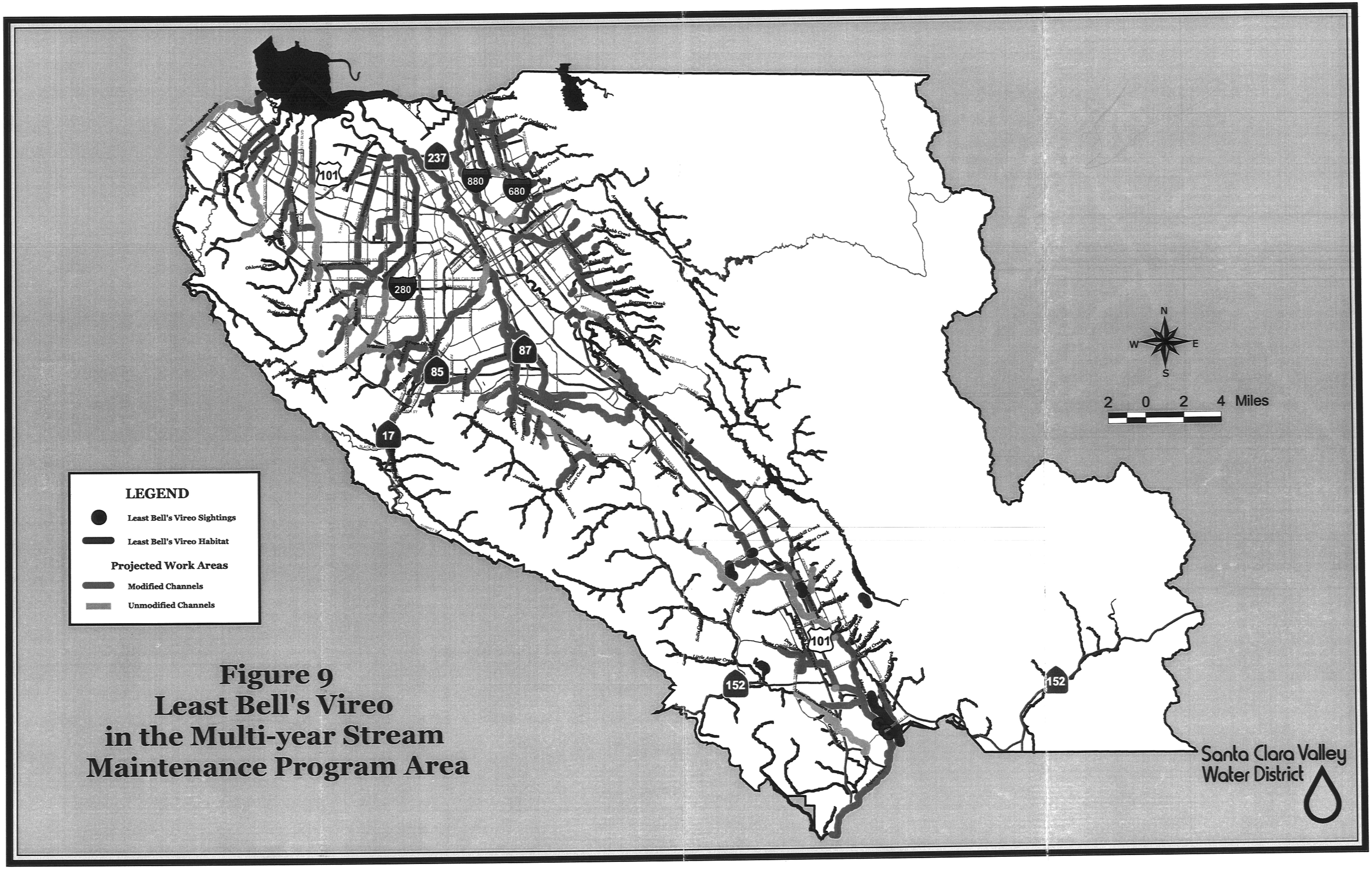
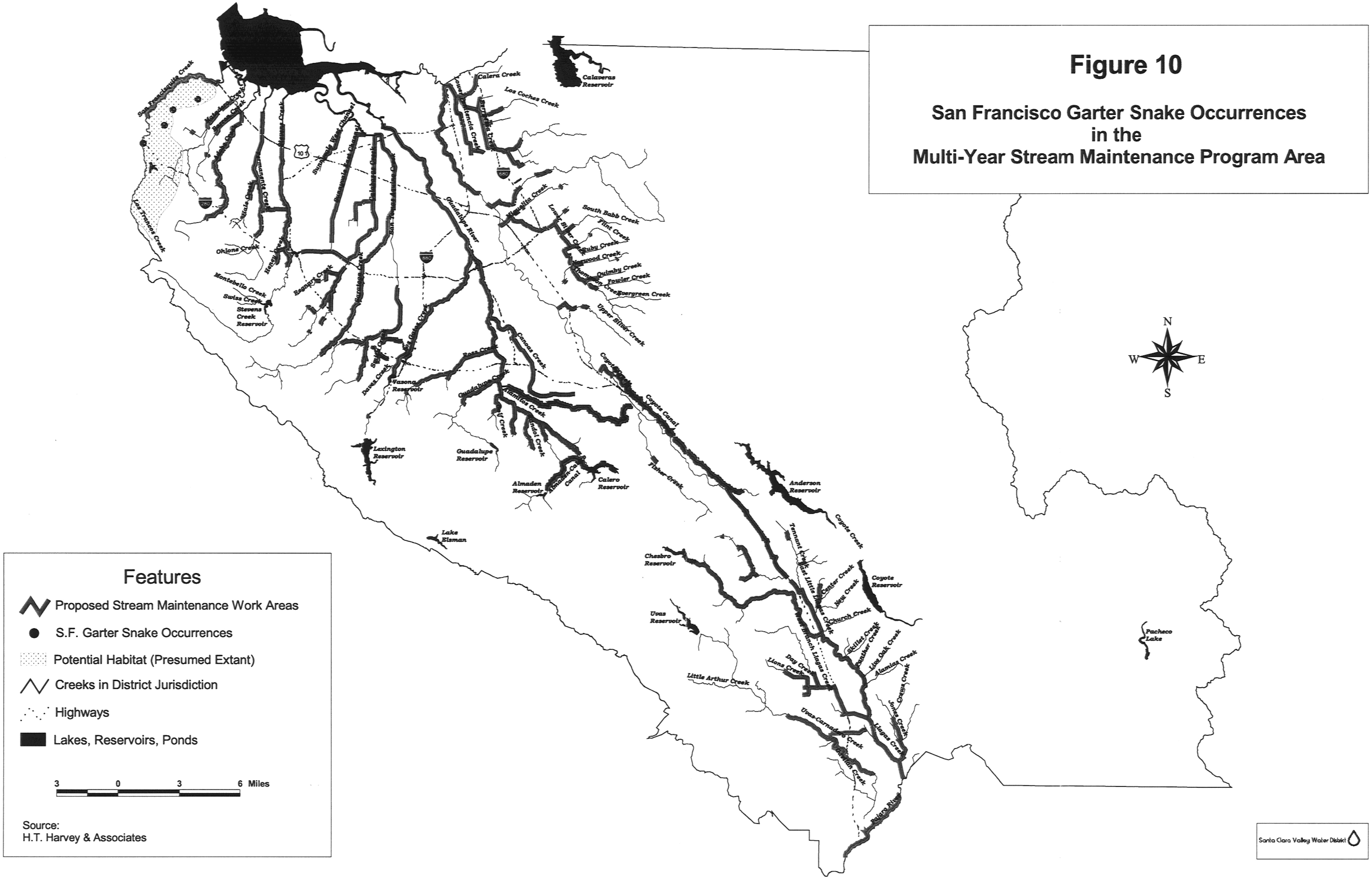


Figure 9
Least Bell's Vireo
in the Multi-year Stream
Maintenance Program Area

000407\2001_138\L_least_bells_vireo_11x17 Sept_12_2001

Figure 10

San Francisco Garter Snake Occurrences in the Multi-Year Stream Maintenance Program Area



Features

- Proposed Stream Maintenance Work Areas
- ● S.F. Garter Snake Occurrences
- ░ Potential Habitat (Presumed Extant)
- Creeks in District Jurisdiction
- Highways
- ■ Lakes, Reservoirs, Ponds

3 0 3 6 Miles

Source:
H.T. Harvey & Associates

Santa Clara Valley Water District

04/20/2001 000407\2001_080\County_SF Garter Snakes_11x17_v1 (Figure 10)

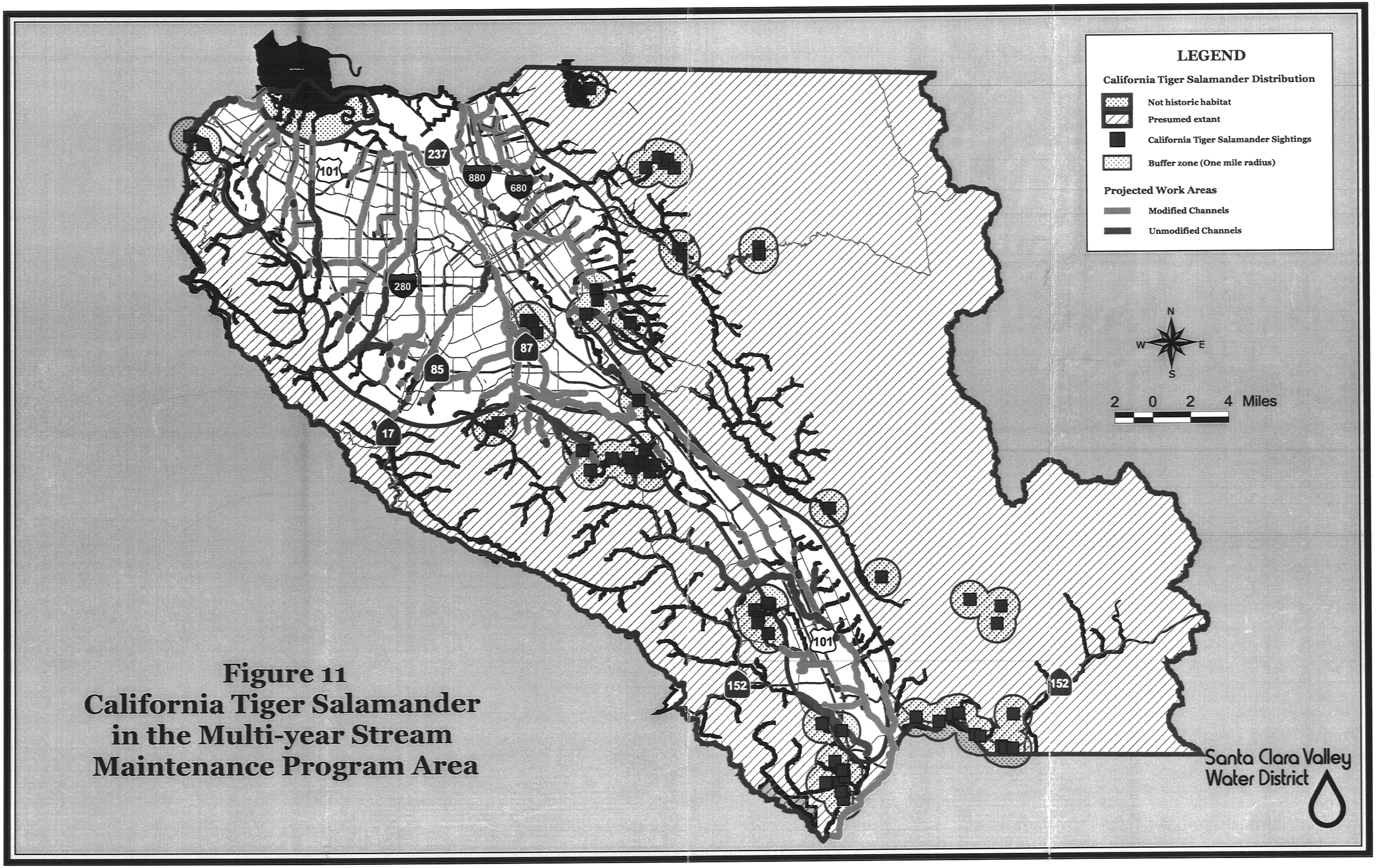
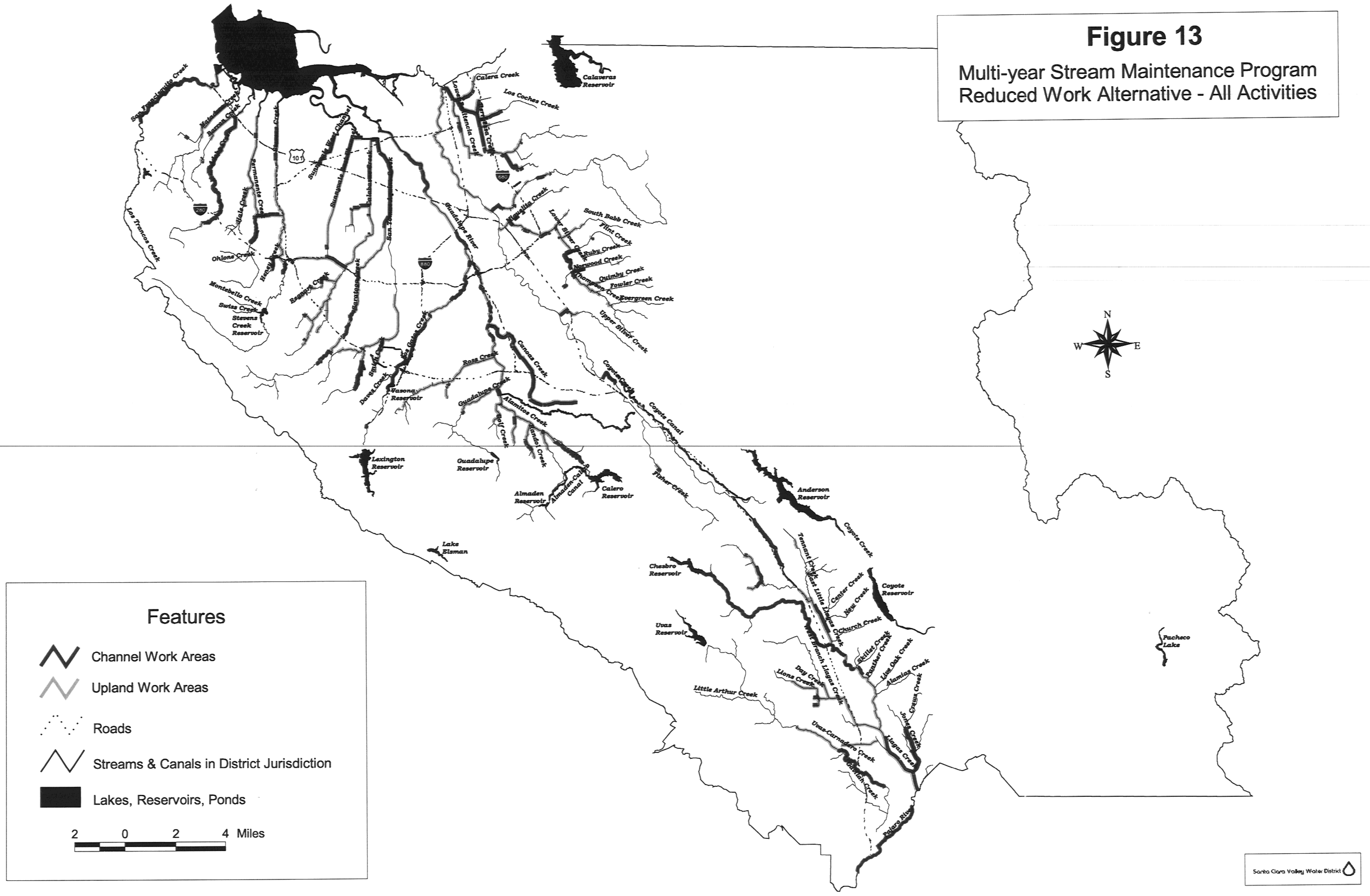


Figure 11
California Tiger Salamander
in the Multi-year Stream
Maintenance Program Area

000407\2001_138\L_ca_tiger_salamander_11x17 Sept_12_2001

Figure 13

Multi-year Stream Maintenance Program
Reduced Work Alternative - All Activities



Santa Clara Valley Water District

04/16/2001 2001_080\Biological_Assessment\County_SMP-Reduced Work Areas_11x17v2(Figure 13)

Attachment A
Best Management Practices List

ATTACHMENT A

IMPLEMENTATION OF BEST MANAGEMENT PRACTICES UNDER THE STREAM MAINTENANCE PROGRAM

Introduction

The District will process all routine stream maintenance activities according to the process and protocols established in Chapter 3 of the Stream Maintenance Program (SMP). The Resource Protection Protocol contained therein includes a step in the annual review process to identify appropriate Best Management Practices (BMPs) for the design and implementation of an activity. (See SMP Figure 3-1.) BMPs are methods that protect environmental quality or reduce environmental impacts from stream maintenance activities. In order to be effective, BMPs must be properly selected and implemented, applied consistently, and their effectiveness evaluated onsite to assure that they are meeting the required objective. The District's Geographic Information System (GIS) will be developed and enhanced to facilitate the stream maintenance project environmental review, processing, and implementation process, particularly for determining potential presence of sensitive species.

Not every BMP is designed to be used in every situation. Since BMPs are meant to be specific to particular activities and resources, the selection and implementation of an appropriate set of BMPs for each project is a key element to their effectiveness. Because of variation in District facilities and the tendency of individual site conditions to change over time, conditions under which each BMP must be applied cannot be strictly prescribed. The staff involved in design and implementation of the maintenance activity must retain some flexibility to determine which BMPs should be implemented according to design objectives and site conditions.

Selection, implementation, monitoring, and improvement of BMPs are all part of the program. Following is a brief discussion of how each of these activities will be applied under the Stream Maintenance Program to assure that resource protection goals are met.

Selection of Best Management Practices

The District will use the most current BMPs when planning or designing routine stream maintenance activities. Work within the Stream Maintenance Program can be divided into two general categories. Regularly scheduled work (most vegetation management, trash pick-up, etc.) is work that occurs in the same place and the same manner with a predictable frequency. Other routine work is not undertaken on a regular annual schedule, but is done as the need arises. This work (sediment removal, bank protection) has a less predictable frequency and location. This work is identified through field surveys, prioritized, and then a work-plan for that particular job is developed. Selection of BMPs will be managed differently for these two types of work.

Selection of BMPs for regularly scheduled work will be done at the beginning of each season (coincides with activity type). Aquatic herbicide application, for example occurs in late summer/early fall. At the beginning of the season, technical staff will review all of the work areas and select appropriate BMPs to respond to site conditions. The BMPs will be incorporated into the work order. If there are questions regarding specific environmental issues, appropriate staff will be consulted and their input will be incorporated.

For work not on a regular schedule, BMP selection is called out in the Resource Protection Protocol. The watershed engineer will, as part of the project design criteria, select BMPs that are appropriate to the particular job and incorporate them into the design package. The BMPs will be called out in the design documents and incorporated into the work order. If there are questions regarding specific environmental issues, appropriate staff will be consulted and their input will be incorporated.

Implementation of Best Management Practices

Best Management Practices will be implemented by lead staff assigned to a specific project. For most projects this would be the Senior Maintenance Worker. The BMPs will be implemented as they are called out in the work order. If site conditions or other factors require a BMP to be changed or make it no longer relevant to the project, the assigned lead on the job will consult with appropriate staff (watershed engineer, qualified environmental staff, etc.) and get authorization to modify the BMPs. Modifications to BMPs will be noted as an addendum to the work order.

Monitoring of Best Management Practices

Monitoring of BMPs will be carried out as part of the work and assigned to the lead staff on a particular project as a general rule. Exceptions would be where the individual BMP requires a particular field of expertise to carry out the monitoring (i.e. water quality sampling, fisheries monitoring). In that instance, qualified staff would be included in the work order as a resource for BMP implementation.

Changes in Best Management Practices

The Best Management Practices section of the Stream Maintenance Program is intended to be a living document and to change over the life of the program. The annual Resource Protection Protocol in Chapter 3 of the Stream Maintenance Program includes a "lessons learned" step to evaluate and improve all aspects of the maintenance program, including the BMPs. As BMPs are used and ways are seen to improve their effectiveness, they will be modified to reflect the changes. As new BMPs are found or technology improves, the program will incorporate them to further protect resources.

Reporting on Best Management Practices

Reporting on modification to BMPs made as a result of the "lessons learned" process will be done as part of the normal reporting practices called out in the Stream Maintenance Program.

Supporting Documents

The BMPs are supported by other District documents that provide more specificity for maintenance project design and implementation.

These documents are attached to the SMP:

Appendix C. Nesting Migratory Bird Procedure
Appendix D. Dryback/Fish Relocation Protocol
Appendix E. Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities

These documents are available from the District:

District Channel Maintenance Guidelines
Bay Area Stormwater Management Agency Association BMPs (2001)

BMP List

The list of BMPs gives a BMP identification number which is used for reference in the SMP and EIR, followed by a short BMP Title, a summary Description of the measure, and the Activity to which the measure will generally apply. The abbreviation for activity is:

SR	Sediment Removal
VM	Vegetation Management
BP	Bank Protection
MM	Minor Maintenance
All	All Routine Maintenance

1. Water Quality
The District shall implement measures to protect water quality, to reduce short-term increases in turbidity, and to maintain the geomorphic integrity of the channels.

BMP	Title	Description	Activity
1.1	Conduct Work During Low Flow Periods	Work instream shall be performed from the spring to fall months when low to no flows are present in the channels. For minor work activities that will occur in the channel, work will be conducted from the top of the bank if access is available and there are flows in the channel.	All
1.2	Tidal Work Areas	For tidal areas, a downstream cofferdam is constructed to prevent the work area from being inundated by tidal flows. By isolating the work area from tidal flows, water quality impacts are minimized. Downstream flows continue through the work area and through pipes within the cofferdam. 1. Installation of coffer dams will begin at low tide. 2. If work can be completed or staged when the work area is not under water, coffer dams will not be necessary. 3. Coffer dams in tidal areas can be made from earthen material. If earth is used, the downstream and upstream faces shall be covered by a protected covering (e.g., plastic or fabric) if needed to minimize erosion.	SR
1.3	Dewater/ Bypass Water at Non-tidal Sites	If water is present at the work site, diversion structures (which can be made of sheet piles, inflatable dams, sand bags, river run gravel, or other similar materials) shall be constructed, as needed, to isolate the work area and avoid or minimize downstream water quality impact. Depending on the channel configuration, water is allowed to either continue flowing downstream or is diverted around the work site in a pipe (pumped or gravity) or open channel. 1. All water shall be discharged in a non-erosive manner (e.g., gravel or vegetated bars, on hay bales, on plastic, on concrete, or in storm drains when equipped with filtering devices, etc.). 2. Sumps or basins may also be used to collect water, where appropriate (e.g., in channels with low flows). 3. Where feasible and appropriate, diversion structures shall be installed on concrete sections of the channels or constructed of materials other than imported earthen fill. Earth fill cannot be used for cofferdams in non-tidal areas. 4. In conjunction with diversion structures, pumps or gravity-fed pipe systems are used to de-water sites. 5. Depending on the channel configuration, sediment removal may occur within a "live" stream–a stream where the flows are not bypassed around the work site; however, during excavation activities, a berm of sediment is left between the work area and stream flows to minimize water quality impacts. 6. In non-tidal channels with anadromous fisheries, diversions shall maintain habitat connectivity and result in no changes in flow quality or quantity from pre-project conditions.	SR BP

BMP	Title	Description	Activity
1.4	Avoid Erosion When Restoring Flows	All temporary diversion structures shall be removed within 48 hours of completion of work. Flows shall be restored in a manner that minimizes erosion. 1. When diversion structures are removed, to the extent practicable, the ponded flows will be directed into the low-flow channel within the work site to minimize downstream water quality impacts. 2. Flows shall gradually be restored to the channel to avoid a surge of water that would cause erosion or scouring. 3. Bypassed flows can be slowly reintroduced into the dewatered area by leaving a silt barrier in place to allow water to slow and drop sediment to the extent possible.	SR BP
1.5	Erosion and Sediment Control Measures	Erosion control methods shall be used as appropriate during all phases of routine maintenance projects to control sediment and minimize water quality impacts. The District shall prevent erosion on steep slopes by using erosion control material according to manufacturer's specifications. Appropriate measures include, but are not limited to, the following: 1. Silt Fences 2. Straw Bale Barriers 3. Brush or Rock Filters 4. Storm Drain Inlet Protection 5. Sediment Traps 6. Sediment Basins 7. Erosion Control Blankets and Mats 8. Soil Stabilization i.e.: Tackified straw with seed, jute or geotextile blankets, etc. The following Bay Area Stormwater Management Agency Association BMPs provide guidance and specifications as to implementation of the erosion control measures described: SC-3. Sediment Basins SC-4. Straw or Sand Bag Barriers SC-5. Sediment Traps SC-6. Silt Fences SS-1. Erosion Control Blankets, Mats, and Geotextiles VR-1. Brush or Rock Filters VR-2. Check Dams VR-4b. Temporary Outlet Protection VR-4b. Storm Drain Inlet Protection WD-1. Earth Dike WD-1. Slope Drain WD-3. Temporary Drains and Swales	BP
1.6	Use of Wheel and Track Mounted Vehicles in Stream Bottoms	District personnel shall use the appropriate equipment for the job that minimizes disturbance to the stream bottom. Appropriately-tired vehicles, either tracked or wheeled, shall be used depending on the situation: 1. Tracked vehicles (bulldozers, loaders) may cause scarification. 2. Wheeled vehicles may cause compaction.	SR BP

BMP	Title	Description	Activity
1.7	Pump/ Generator Set Operations and Maintenance	Pumps and generators shall be maintained and operated in a manner that minimizes impacts to water quality and aquatic species. 1. Pumps and generators shall be maintained according to manufacturers' specifications to regulate flows to prevent dryback or washout conditions. 2. Pumps shall be operated and monitored to prevent low water conditions, which could pump muddy bottom water, or high water conditions, which creates ponding. 3. Pump intakes shall be screened to prevent uptake of fish and other vertebrates.	SR BP MM
1.8	Handle Sediments So As to Minimize Water Quality Impacts	Sediments shall be stored and transported in a manner that minimizes water quality impacts. 1. Wet sediments may be stockpiled outside of a live stream or may be stockpiled within a dewatered stream so water can drain or evaporate before removal. This measure applies to saturated, not damp, sediments and depends upon the availability of a stockpile site. 2. For those stockpiles located outside the channel, water draining from them will not be allowed to flow back into the creek or into local storm drains that enter the creek, unless water quality protection measures recommended by the RWQCB are implemented. 3. Trucks may be lined with an impervious material (e.g., plastic), or the tail gate blocked with dry dirt or hay bales, for example, or trucks may drain excess water by slightly tilting their loads and allowing the water to drain out. 4. Water shall not drain directly into channels (outside of the work area) or onto city streets without providing water quality control measures. 5. Streets shall be cleaned of mud and/or dirt by street sweeping, as necessary, and not by hosing down the street.	SR
1.9	Soil Stockpiles	If soil is to be stockpiled, no run-off will be allowed to flow back to creek.	SR

BMP	Title	Description	Activity
1.10	Avoid Exposing Soils with High Mercury Levels	Bank Protection projects in portions of the Guadalupe River watershed affected by historical mercury mining may expose soils containing mercury which can affect stream water quality. 1. In the specified channel reaches in the Guadalupe River Basin, soils that are likely to be disturbed or excavated shall be tested for Mercury (Hg). Soils shall be remediated if: a. disturbed or excavated soils exposed to flood flows below the 2.33-year channel flow level exceed 1 ppm Hg, or b. disturbed or excavated soils above the 2.33-year flow level exceed 20 ppm Hg. 2. Remediation can be accomplished either by: a. treating the site so that contaminated soils excavated for the purpose of installing bank protection will not be susceptible to erosion, or b. by further excavating contaminated soils and replacing them with clean fill or other bank protection materials that are free from contaminants. c. Soils with mercury concentrations exceeding 20 mg/kg will be removed and disposed of in a Class I landfill following established work practices and hazard control measures. 3. To ensure worker safety is protected during bank protection projects with elevated mercury concentrations in the exposed surfaces, personal protective equipment will be required during project construction to maintain exposure below levels established by the Occupational Safety and health Agency (OSHA).	BP
1.11	Concrete Use Near Waterways	Concrete that has not been cured is alkaline and can increase the pH of the water; fresh concrete will be isolated until it no longer poses a threat to water quality. 1. Wet sacked concrete shall be excluded from the wetted channel for a period of two weeks after installation. During that time, the wet sacked concrete shall be kept moist (such as covering with wet carpet) and runoff from the wet sacked concrete shall not be allowed to enter a live stream. 2. Poured concrete shall be excluded from the wetted channel for a period of two weeks after it is poured. During that time, the poured concrete shall be kept moist, and runoff from the wet concrete shall not be allowed to enter a live stream. Commercial sealants (e.g., Deep Seal, Elasto-Deck Reservoir Grade) may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If a sealant is used, water shall be excluded from the site until the sealant is dry. 3. Dry sacked concrete shall not be used where they will have contact with the wetted channel. 4. Designate an area outside of the channel and floodplain to clean out concrete transit vehicles.	BP

BMP	Title	Description	Activity
1.12	Groundwater Management	If high levels of groundwater in a work area are encountered, the water is pumped out of the work site. If necessary to protect water quality, the water shall be directed into specifically constructed infiltration basins, into holding ponds, or onto areas with vegetation to remove sediment prior to the water re-entering a creek. Water pumped into vegetated areas will be pumped in a manner that will not create erosion around vegetation.	SR BP
1.13	Prevent Scour Downstream of Sediment Removal	Sites in the transport zone on alluvial fans may cause increased scour downstream if they experience rapid sediment accumulation after sediment removal. Channel reaches up to 500 feet downstream from such sediment removal sites will be monitored to determine whether accelerated erosion is occurring. If downstream monitoring indicates that erosion is occurring, then remedial action such as rock vortex weirs or similar protection shall be carried out.	SR
1.14	Minimize Sediment Transport Downstream from In-channel Herbicide Sites	Where sediment has accumulated due to vegetation in-channel, herbicide application may result in release of sediment downstream. Prior to herbicide application within active channels, the potential for significant sediment release will be assessed. If the site has the potential for significant sediment release, then one of two techniques will be considered: 1. Where an area has not been routinely treated with herbicides, phase new herbicide applications over several seasons, or 2. Remove the excess sediment through mechanical means after the vegetation is killed.	VM
1.15	Prevent Erosion Downstream of Bank Protection Sites	Increased water velocity at bank protection sites may increase erosion downstream. Bank stabilization site design will assess hydraulic effects immediately upstream and downstream of the work area. If the hardscape revetment would cause significant increase in erosion potential, downstream energy dissipation features such as pools or grade control structures shall be considered in the design. If the evaluation identifies possible downstream impacts, proactive protection of these areas shall be provided. Such measures include, but are not limited to, coir logs, riparian enhancement planting, strategic placement of rock, and flow deflectors.	BP
1.16	Minimize Local Erosion Increase from In-channel Vegetation Removal	In-channel vegetation removal may result in increased local erosion due to increased flow velocity. To minimize the effect, protect the toe of the bank by leaving vegetation to the maximum extent possible consistent with the maintenance guidelines.	VM

2. Vegetation

The District shall strive to minimize vegetation removal and shall revegetate sites as appropriate to provide erosion control and restore riparian habitat value.

BMP	Title	Description	Activity
2.1	Minimize Vegetation Removal	Vegetation control and removal in channels, on streambanks, and along levees and maintenance roads shall be limited to removal necessary for facility inspection purposes, removal that is necessary to meet regulatory requirements, removal that is required to comply with fire codes, and removal that is required to meet capacity requirements per Maintenance Guidelines.	
		1. The District has developed detailed Maintenance Guidelines to address the ongoing need for maintenance of vegetation or sediment in modified streams and channels. The guidelines are engineering-based and outline the level of maintenance required to ensure adequate flood protection capacity is maintained in the streams and canals within the District's jurisdiction.	All
		2. Decisions regarding the necessity of routine sediment removal and vegetation management activities (to restore channel flow capacities) will be made following the thresholds established in the guidelines. This information will be used to formulate in part an annual routine maintenance work plan.	All
		3. No more than one-quarter acre of wetland or riparian vegetation will be removed during minor work activities.	MM
2.2	Minimize Stream Access Impacts	District personnel shall use existing access ramps and roads where possible. If new access points are necessary, they shall be constructed in a manner that minimizes impacts to streams:	SR BP
		1. New access points shall be created as close to the work area as possible to minimize running equipment down stream channels.	
		2. On temporary access points, remaining disturbed soil shall be compacted and seeded immediately after construction of new access points.	
		3. New access points will be constructed so as to minimize adverse impacts, such as tree removal, whenever possible.	
		4. If the access point is to be permanent, the road or ramp will have a gravel surface.	
		5. Any temporary fill used for access shall be removed upon completion of the project. Channel topography and geometry shall be restored to pre-project conditions to the extent possible.	

BMP	Title	Description	Activity
2.3	Minimize Hardscape in Bank Protection Design	The District shall select bank repair techniques appropriate to a given site based on hydraulic and other site conditions. Refer to SMP Appendix E. Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities . 1. Biotechnical repair methods include live construction, willow wattling, erosion control blankets, brush matting, and installation of root wads and boulders in banks. 2. The repair will be designed and installed so that it will be self-sustaining and use vegetation that adds structural integrity to the stream bank.	BP
2.4		*[This BMP intentionally left blank for any future additions.]*	
2.5	Planting	Planting for erosion control and habitat restoration shall be in accordance with District revegetation guidelines.	BP
2.6	Mulching	Bark and other wood products shall be used as needed to prevent erosion of bare soil after construction is completed. 1. All newly planted and/or bare soil (excluding bare channel bottoms) in maintenance areas shall have a minimum 3" thick layer of bark or mulch installed except when the area is seeded. In that case, the thickness of the mulch layer shall not exceed ½ inch. 2. This bark or mulch can be ground-up woody products and/or leaves from either native material or from soil suppliers. 3. No non-native material that has allelopathic compounds (*Eucalyptus* spp.) or weed seeds shall be used as mulch in areas where it has the potential to inhibit native revegetation. Such areas would include floodplains and revegetation sites. 4. Any material imported from outside the District that is to be used as mulch will be certified as weed-free to the extent that certification is possible.	BP
2.7	Seeding	For banks that are scraped during sediment removal, an erosion control seed mix will be used. 1. A typical mix may consist of California native grasses (e.g., *Hordeum brachyantherum, Elymus glaucus* 'Berkeley,' *Bromus carinatus*) on slopes flatter than 3:1. *Vulpia microstachyes* may be added to the mix where slopes are steeper (e.g., 2:1). 2. Another seed mix may be of 'Escort' sterile wheat to provide a year's worth of protection. This mix is used only if further work is required the following year. 3. Temporary earthen access roads will be seeded when site and horticultural conditions are suitable.	SR

BMP	Title	Description	Activity
2.8	Replace Trees	The District shall replace trees as follows: 1. Native trees between 6 and 18 inches in diameter at breast height (dbh) that are lost due to bank protection impacts will be replaced at a ratio of 3:1. Non-native trees between 6 and 18 inches dbh will be replaced at a ratio of 1:1 with appropriate native species. 2. Trees removed for installation of bank protection measures shall be replaced at the site, if feasible, or at the mitigation site created for that bank protection activity. 3. The Plant Selection Criteria, Planting Techniques, Maintenance, and Monitoring/Reporting protocols prescribed by the "Protocol for Revegetation Associated with Bank Protection" (Appendix E of SMP) shall be implemented, as applicable to tree replacement. 4. Replacement of heritage-sized trees (greater than 18 inches dbh) will be consistent with local ordinances.	BP
2.9	Revegetation Site Maintenance	Follow-up maintenance shall be performed on sites that have been seeded and planted. 1. Maintenance shall include replacing dead or dying plants where appropriate, weeding, removing non-native plant colonizers, and ensuring that all plants receive sufficient water. 2. Irrigation shall be implemented as needed throughout the establishment period.	BP

3. Wildlife and Fisheries

The District shall implement measures to minimize impacts to native species, especially special-status and riparian dependant species.

BMP	Title	Description	Activity
3.1	Minimize Impacts to Special-status Plants and Animals Via Site Assessments and Avoidance Measures	To avoid and minimize impacts to special-status plant and wildlife species, the annual work program shall be reviewed, and each site where special status species have been found, have been known to exist in the recent past, or are likely to occur because suitable habitat exists, will be visited by a biologist or qualified personnel under the direction of a biologist. For animal species the site surveys will be no more than 30 days prior to the start of construction or during the time of the year the species is expected to occur on-site, to determine presence of special-status species. For plant species the surveys will be conducted during the appropriate time of the year to determine presence. Information regarding the presence of special-status species on a particular worksite shall be based on the District's GIS database and professional experience of qualified staff. 1. The District shall use its GIS database to identify potential special-status plant and animal habitats. All projects falling within sensitive habitats will be discussed with biological staff to identify avoidance and minimization measures. 2. All populations detected during the surveys will be assessed and mapped. This information will be entered into the District's GIS system for future management purpose. 3. If maintenance activities are scheduled in the vicinity of extant populations, qualified personnel under the direction of a biologist will clearly identify the populations on site and stake or flag a buffer zone around the population in which activities are to be avoided. 4. Avoidance of impacts to serpentine areas or other sensitive plant habitats may include storing removed sediment offsite, limiting the method of vegetation removal to manual methods, and limiting the operation of maintenance equipment to established roads whenever possible. 5. Vegetation management in sensitive plant areas will use only hand control or backpack herbicide application by operators trained to identify and avoid the species to be protected. 6. If sensitive animals such as western pond turtles or California red-legged frogs are found, a qualified biologist will remove them to suitable habitat outside of the project limits. Moving animals will be consistent with applicable Fish and Wildlife Service and Fish and Game permits. 7. The results of all sensitive species surveys will be reported to the Fish and Wildlife Service, National Marine Fisheries Service and the California Department of Fish and Game in an annual report. All surveys will be reported to the CNDDB. 8. The District will develop and distribute informational pamphlets entitled "Sensitive Plants, Wildlife, and Fish at your Worksite." These pamphlets are designed to inform staff about sensitive species and environmental protocols and procedures.	All

BMP	Title	Description	Activity
3.2	Minimize Impacts to Nesting Birds Via Site Assessments and Avoidance Measures	District personnel shall conduct SMP work in a manner consistent with the protocols established by the most current version of the District's Nesting Migratory Bird Procedure: 1. Project areas will be checked by qualified personnel under the direction of biologists for nesting birds prior to starting work if the work has the potential to impact nesting birds. 2. If nesting birds are found, implementation of a project may be delayed until after nesting is completed. Work may occur if an adequate buffer, as determined by a qualified biologist, can be established between the maintenance activity and nests.	All
3.3	Avoid serpentine habitat	The District shall identify serpentine areas and avoid disturbance to these areas to the extent possible. 1. The District shall use its GIS database to identify serpentine areas near work areas and avoid and minimize impacts to all stands of native vegetation that may provide suitable habitat for special-status plants and invertebrates to the greatest extent possible. 2. Avoidance measures may include storing removed sediment offsite, limiting the amount of vegetation to be sprayed and removed in serpentine areas, and limiting the operation of maintenance equipment to established roads whenever possible. 3. Facilities crossing serpentine soil grasslands shall be permanently marked in the field (and in the District GIS) and will include 100 ft. buffer zones. No upland herbicides will be used in these marked areas. Aquatic herbicides may be used after July 1. Upland vegetation control using hand labor may occur after June 15. 4. Facilities crossing serpentine soil shrub lands and woodlands will be surveyed by a qualified botanist. Areas supporting sensitive species shall be permanently marked in the field (and in the District GIS) and will include 100 ft. buffer zones. No upland herbicides will be used in these marked areas. Aquatic herbicides may be used after July 1. The botanist will determine what area's vegetation management using hand labor may occur after June 15. Buffer zones around individual plants or populations may be established.	All
3.4	Mitten Crab Control Measures	Sediment from the San Francisco Bay Watershed, including that for reuse, will not be removed to areas any farther south than Coyote Valley or outside of the San Francisco Bay watershed unless previously authorized by CDFG. This measure is to avoid transporting mitten crabs, a highly invasive, exotic species, to areas where they are not currently found.	SR

BMP	Title	Description	Activity
3.5	Minimize Loss of Aquatic Habitat from Bank Protection Work	Follow SMP Appendix E. Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities.	BP
3.6	Remove Sediment from One Side of Large Channels in Alternate Years	Some channels are large in the sense that sediment removal operations must be conducted from both sides of the channel. Remove sediment in large channels from one side only in alternate years to minimize vegetation removal and retain emergent vegetation, which is used for food, cover, fish spawning and nursery areas, and wildlife movement corridors. According to the Maintenance Guidelines, this measure applies to the following channel reaches (Station Nos.): 1. Stevens Ck. (0+00–146+00) 2. Calabazas Ck. (0+00–102+00) 3. San Tomas Ck. (0+00–151+40) 4. Alamitos Ck. (42+65–218+00) 5. Guadalupe River (230+00–387+50) 6. Berryessa Ck. (0+00–200+00) 7. Lower Penitencia (0+00–40+00) 8. Silver Ck. (100+00–315+40) 9. Thompson Ck. (0+00–48+00)	SR
3.7	Salvage Native Aquatic Vertebrates from Dewatered Channels	If fisheries or native aquatic vertebrate are present when cofferdams, water bypass structures, and silt barriers are to be installed, a fish and native aquatic vertebrate relocation plan will be implemented to ensure that fish and native aquatic vertebrates are not stranded: 1. In non-tidal channels, where water is to be diverted, prior to the start of work or during the installation of water diversion structures, native aquatic vertebrates will be captured in the work area and transferred to another reach as determined by a qualified biologist (refer to Fish Relocation Guidelines) 2. Aquatic invertebrates will not be transferred (other than incidental catches) because of their anticipated abundance and colonization after completion of the repair work.	SR BP
3.8	Minimize Effects of Bypass Structures on Steelhead	To prevent increases in temperature and decreases in dissolved oxygen (DO), if bypass pipes are used, they shall be properly sized (i.e., larger diameter pipes to better pass the flows). Bypass pipes may also be avoided by creating a low-flow channel or using other methods to isolate the work area.	SR BP

BMP	Title	Description	Activity
3.9	Retain Woody Materials and Vegetation	Woody material (including live leaning trees, dead trees, tree trunks, large limbs, and stumps) will be retained unless it is threatening a structure or impedes reasonable access. 1. Retain and flag stumps, snags, and branches in channels that can create fish habitat. 2. Ensure that this woody debris does not impede water flow and does not contribute to erosion. 3. When woody material is removed, priority will be given to reuse of the materials in bank protection projects. Non-native species containing allelopathic compounds will not be used for construction of bank protection projects. Woody materials may also be used as mulch. (See BMP 2.6) 4. When retention will not compromise flood management system reliability, woody vegetation shall be left in place.	BP MM
3.10	Conduct In-Channel Work During the Dry Season	Avoid and minimize impacts to salmonids by timing stream maintenance projects in streams where there are or could be salmonids so that the use of heavy equipment in the channel is conducted outside of the migration and spawning season. 1. Avoid use of heavy equipment during salmonid migration and spawning season between October 15 to June 15. 2. In-stream work in salmonid streams may be extended after October 15th under the following conditions: • There has been no significant rainfall. • A request for an extension has been submitted to California Department of Fish and Game in writing by October 1st. • The project or projects for which extensions are being requested are at least 50% complete or can be completed within 5 business days. • National Marine Fisheries Service and California Department of Fish and Game review the request and concur that an extension would not pose an undue threat to resources. • No work under these conditions may occur after October 30th. 3. Minor maintenance activities that have no impact on fisheries may be done on all streams at any time of the year. These activities include fence repair, graffiti removal, tree pruning outside the low flow channel, revegetation maintenance, rodent control, and other activities that do not occur in the water. 4. In streams where there are or could be salmonids, minor activities will be done in channel if the activity is necessary to provide immediate flood protection. These activities include removal of trash or debris that will impede flows, trash rack cleaning, and pier nose cleaning. These activities will be done in a manner that is sensitive to protection of fisheries resources.	SR BP

BMP	Title	Description	Activity
3.11	Avoid Dewatering an Entire Isolated Stream Reach	Construction sites may be isolated by upstream or downstream barriers, such as culverts. In reaches that contain deep pools, the District shall maintain these pools as refuges by constructing temporary barriers so as to avoid pool destruction when preservation of the pool is not in the construction footprint or a barrier to project access. This BMP does not apply to sediment removal activities that require the removal of all sediment to restore the design capacity.	SR BP
3.12	Maintain Low-low Fish Passage	If site conditions after work create a flat channel bottom in non-tidal channels, a low flow channel will be created before reintroduction of flows to allow fish passage. The goal is to avoid sheet flow only a few inches deep. This measure does not apply to tidal areas.	SR BP
3.13	Remove Temporary Fills as Appropriate	Temporary fills, such as for access ramps, diversion structures, or cofferdams, shall be completely removed upon finishing the work, except where clean river run cobble/gravel was used. When appropriate, some or all of such material may be left in the channel to provide a substrate for aquatic species.	SR BP
3.14	Maintain or Provide Escape Cover	Stable undercut banks (generally those maintained by roots or boulders) shall remain in place. Larger boulders (≥2-foot diameter) with minimum 4-12" gaps used for rip-rap may provide cavities as escape cover that are not provided by sacked concrete, small rip-rap, or larger rip-rap with small rock in-fill.	BP
3.15	Restore Pool Configuration of Channel Bottom	The District shall re-grade the channel bottom at the end of the work project to as close to original conditions as possible. 1. In areas used for migration by salmonids as designated on the District GIS Fisheries coverage, the depth and size of the low flow channel and pools shall emulate the pre-construction conditions as closely as possible, within the finished channel topography. 2. All material used to construct temporary fills will be removed upon completion of the project.	SR BP
3.16	Restore Spawning Gravels in Work Site Areas	The District shall replace gravels at the end of construction in potential salmonid spawning reaches. 1. Spawning gravels removed as a result of stream maintenance activities in active spawning locations will be replaced using a gravel-cobble mixture with the following specification: the cobble/gravel material shall be made up of 30% 8-inch cobble, 30% 4-inch cobble, 30% 2-inch gravel, 10% ½-inch gravel, and no fines. 2. Spawning gravel replacement will be configured to maximize functional benefits including salmonid spawning, aquatic invertebrate production, and juvenile escape cover.	SR BP

BMP	Title	Description	Activity
3.17	Reuse Sediments and Gravels As Appropriate	Where practical, the District will reuse removed sediments and gravels. 1. Sediments that are considered for re-use will be tested for hazardous materials and graded for structure as necessary in order to determine their appropriateness for re-use. When sediments or gravels are reused, the District will ensure that the reuse does not cause any additional erosion, siltation, or other negative environmental consequences. Reuse will be considered within the context of environmental, regulatory, and fiscal consequences. 2. Re-use will be considered within the context of environmental, regulatory, and fiscal consequences.	SR
3.18	Herbicide Use in Aquatic Areas	Only herbicides and surfactants registered for aquatic use will be applied within the banks of channels within 20 feet of any water present. Aquatic herbicide use is limited to July 1st through October 15th, except on Guadalupe River, where it is limited to July 1st to August 15th. If rain is forecast within 24 hours, then application of aquatic herbicide will be rescheduled.	VM

BMP	Title	Description	Activity
3.19	Develop a Biodiversity Monitoring Program	The District commits to developing and implementing a biodiversity monitoring program in conjunction with SMP. The focus of the program will be on special-status species and their habitats. Monitoring results will be incorporated into future BMP and maintenance design through the "lessons learned" process of annual review (refer to SMP Figure 3-1) so as to more effectively conserve and restore stream habitats. 1. Monitoring protocols for listed species will be approved by the Fish and Wildlife Service, National Marine Fisheries Service or California Department of Fish and Game as appropriate. 2. The results of all sensitive species monitoring will be reported to the Fish and Wildlife Service, National Marine Fisheries, and the California Department of Fish and Game in an annual report. All surveys will be reported to the CNDDB. 3. Monitoring will be conducted during the appropriate time of year for each species under investigation. 4. All populations detected during the monitoring will be assessed and mapped. This information will be entered annually into the District's GIS system for future management purposes. 5. Sensitive species monitoring and baseline surveys may include activities such as: California red-legged frog surveys and western pond turtle trapping covering at least 20 miles of stream per year (repeat surveys every 5 years); survey at least 2 miles of California Clapper Rail habitat per5 year for 5 years; map the distribution of pickleweed and cordgrass within and adjacent to District facilities every 5 years; survey at least 10 miles of creek annually for raptor nest locations; survey known burrowing owl locations on Duistrict facilities annually; survey at least 10 miles of creek annually for western leatherwood (repeat every 5 years); monitor distribution of Bay checkerspot and Opler's longhorn moth habitat on District facilities every 3 years; monitor at least 2 miles of freshwater and tidal emergent marsh for sensitive bird use annually (repeat every 5 years); monitor at least 5 miles of riparian habitat annually for sensitive birds (yellow warbler) (repeat every 5 years); survey serpentine habitats for sensitive plants at least every 3 years. 6. Update the figure "Fisheries present in streams within jurisdiction of the Santa Clara Valley Water District" (Figure IVB1) every 5 years.	All

BMP	Title	Description	Activity
3.20	Minimize Adverse Effects of Herbicides on Non-target Species	Herbicides are a key component of vegetation management under the SMP. Herbicides shall be used in a manner that minimizes negative environmental effects by avoiding impacts to non-target species. Herbicide use will be guided by label restrictions and any advisories published by the California Department of Pesticide Regulation (CDPR) or the County Agricultural Commission. The US EPA bulletin *Protecting Endangered Species, Interim Measures for Use of Pesticides in Santa Clara County* provides additional guidelines for herbicide use (US EPA 2000). 1. Herbicide use will be reviewed annually prior to application using information from CDPR and US EPA maintained in the District GIS database to determine the potential presence of special-status species that could be adversely affected, and the target areas and chemicals used will be modified as necessary. 2. To avoid toxic effects to all life stages of California Red-legged Frogs (RLF), whenever herbicides are to be used in within 1.25 miles of known RLF locations, the District will refer to both the product label for the material being used and the Endangered Species Database maintained by the California Department of Pesticide Regulation and use the lower of the two recommended rates if there is a difference. 3. Applications of herbicides with an aquatic species hazard class shall only be made when the air is calm or moving away from habitat as determined by the certified applicator immediately prior to the application with the use of an anemometer. Applications shall commence on the side nearest the habitat and proceed away from the habitat. If air movement prohibits such products from being applied in compliance with this BMP alternative products or methods shall be used in these areas.	VM

BMP	Title	Description	Activity
3.21	Minimize Rodenticide Impacts on Non-target Species	Burrowing rodents are controlled to minimize damage to levees on streams and canals. Rodent control areas will be reviewed for the potential presence of special-status species and the rodent control methods tailored to minimize non-target species impacts. When chemical control is necessary, the use will be guided by label restrictions and any advisories published by the California Department of Pesticide Regulation (CDPR) or the County Agricultural Commission. The EPA bulletin *Protecting Endangered Species, Interim Measures for Use of Pesticides in Santa Clara County* provides additional guidelines for rodenticide use (USEPA 2000). 1. Within the potential range of salt marsh harvest mouse (SMHM) (as designated on the District's GIS), lethal rodent control methods shall not be used. The District defines potential SMHM habitat as all areas north of Highway 237 as shown in Figure IV B11, and will refine this definition as surveys are conducted to eliminate areas that are separated by barren ground by at least 10 yards from any halophytic vegetation. 2. In areas occupied by burrowing owls, fumigants shall not be used unless specifically determined safe by a qualified biologist. a. The location of Burrowing Owls will be identified on the District's GIS system. b. A 1/4 mile buffer zone around burrowing owl locations will be established. c. If necessary alternative methods of rodent control will be determined by a qualified biologist. 3. The rodenticide applicator shall remove carcasses of poisoned animals, when they are found, to minimize secondary toxic effects on raptors or other wildlife. Carcass survey and disposal shall be performed in the treated area beginning on the third day following the initial exposure of toxic baits. Any exposed carcasses shall be disposed of in a manner inaccessible to wildlife. Carcass surveys shall continue for at least 5 days after toxic baiting has ceased and thereafter until no more carcasses are found. Any dead raptors or other wildlife found in the treated area during the carcass surveys shall be turned over to CDFG's pesticide lab for analysis.	MM
3.22	Herbicide Use in Upland Areas	Application of herbicides to upland areas shall not be made within 24 hours of predicted heavy rainfall.	

4. Land Use and Public Safety
The District shall minimize disturbance to the public and ensure public safety.

BMP	Title	Description	Activity
4.1	Notify Local Governments of Scheduled Work	Notify cities and the County of proposed work by submitting the Annual Work Plan to the Public Works Departments and the District's Zone Advisory Committee.	All
4.2	Minimize Disturbances to Surrounding Neighborhoods	The District shall implement maintenance practices that minimize disturbances to neighborhoods surrounding work sites. 1. In general, work shall be conducted during normal working hours. Extending weekday hours and working weekends may be necessary to complete some projects. 2. Internal combustion engines shall be equipped with adequate mufflers. 3. Excessive idling of vehicles will be prohibited. 4. Levee traffic shall be limited to a speed of 15 miles per hour. 5. Access roads shall be watered as needed to control dust. 6. Dry sediment shall be wetted down or covered as needed to control dust during transport.	All
4.3	Stabilized Construction Entrance	The District shall implement measures to minimize soil from being tracked onto streets near work sites: 1. Methods used to prevent mud from being tracked out of work sites onto roadways include installing a layer of geotextile mat, followed by a 4-inch thick layer of 1-3- inch diameter gravel on unsurfaced access roads. 2. Access shall be provided as close to the work area as possible, using existing ramps where available and planning work site access so as to minimize disturbance to the creek bed, creek banks, and the surrounding land uses.	SR BP
4.4	Sanitary/Septic Waste Management	Temporary sanitary facilities shall be located on jobs that last multiple days. All temporary sanitary facilities shall be placed outside of the creek channel and floodplain.	All
4.5	Vehicle and Equipment Cleaning	District vehicles shall be washed only at the approved area in the corporation yard. No washing of vehicles shall occur at job sites.	All
4.6	Work Site Solid Waste Management	District employees and contractors shall clean the work site before leaving by removing all litter and construction related materials. The District's maintenance crews shall be responsible for all debris incurred as a result of construction and for cleaning up dumped material.	All
4.7	Herbicide Use Requirements	All herbicide use shall be consistent with approved product specifications. Applications shall be made by, or under the direct supervision of, State Certified applicators under the direction of a licensed Pest Control Advisor.	VM

BMP	Title	Description	Activity
4.8	Implement Public Safety Measures	The District shall implement public safety measures during maintenance: 1. Construction signs shall be posted at job sites warning the public of construction work and to exercise caution. 2. When necessary, a person shall be provided for traffic control. 3. If needed, a lane shall be blocked off to allow for trucks to pull into and out of the access points. 4. Where work is proposed adjacent to a recreational trail, warning signs shall be posted several feet beyond the limits of work. 5. Fencing, either the orange safety type or chain link, shall be installed above repair sites on bank stabilization projects.	All
4.9	Notify Park Departments of Trail Closures	As part of the Annual Work Plan, The District will notify the park departments of trails that could be subject to closure. The type of work, location and duration of each project that will affect trail closures will be identified.	SR BP VM

5. Air Quality

The District shall implement dust control measures at work sites to protect air quality and minimize effects on adjacent neighborhoods.

BMP	Title	Description	Activity
5.1	BAAQMD Basic Dust Control Measures	The District shall implement BAAQMD Basic Control Measures at maintenance sites less than four acres in size. Current measures stipulated by the BAAQMD CEQA Guidelines include the following: 1. Active maintenance areas shall be watered at least twice per day unless soils are already sufficiently moist to avoid dust. 2. Trucks hauling sediments and other loose material shall be covered or shall maintain at least two feet of freeboard. 3. Tailgates of trucks shall be sealed. 4. Trucks shall be brushed down before leaving the maintenance site. 5. Unpaved access roads and staging areas that are being used for the maintenance activity shall be watered three times daily, or non-toxic soil stabilizers shall be applied to control dust generation. 6. Paved maintenance site access roads shall be swept when visible soil material is carried onto the roadway.	SR BP

BMP	Title	Description	Activity
5.2	BAAQMD Enhanced Dust Control Measures	For single maintenance sites greater than four acres, the District shall implement BAAQMD Enhanced Dust Control Measures. These measures include the following: 1. Inactive areas shall be sprayed with soil stabilizer or seeded. 2. Exposed stockpiles shall be watered, enclosed, covered, or sprayed with soil stabilizers. 3. Traffic speeds shall be limited to 15 mph. 4. Sandbags or other bank protections shall be installed to prevent silt runoff to roadways. 5. Vegetation in disturbed areas shall be replanted as soon as horticulturally appropriate. For example, plant material may not be ready as soon as the job is done (e.g. willow cuttings have to be collected during winter dormancy).	SR BP
5.3	Avoid Stockpiling Potentially Odorous Sediments	Some of the sediment removal sites will have sediment that is rich in organic matter decaying in an anaerobic conditions, which generates assorted malodorous gases, such as reduced sulfur compounds. These sediments shall be handled in a manner that avoids impacting sensitive receptors. 1. The District shall avoid stockpiling potentially odorous sediments within 1000 feet of residential areas or other odor sensitive land uses. 2. Where appropriate, odorous stockpiles shall be disposed of at an appropriate landfill.	SR

6. Hazardous Materials
The District shall implement hazardous materials protocols to protect environmental quality and public safety.

BMP	Title	Description	Activity
6.1	Spill Prevention	The District shall prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels. 1. District field personnel will be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills. 2. No fueling, repair, cleaning, maintenance, or vehicle washing shall be performed in the creek channel or in areas at the top of the channel bank that may flow into the creek channel.	All
6.2	Spill Kit Location	Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations). 1. Prior to entering the work site, all field personnel will know the location of spill kits on crew trucks and at other locations within District facilities. 2. All field personnel will be advised of these locations and trained in their appropriate use.	All

BMP	Title	Description	Activity
6.3	Hazardous Materials Management	The District shall implement measures to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means when removing sediments from the streams. 1. Prior to entering the work site, all field personnel will know how to respond when toxic materials are discovered. 2. The discharge of any hazardous or non-hazardous waste as defined in Division 2, Subdivision 1, Chapter 2 of the California Code of Regulations shall be conducted in accordance with applicable State and federal regulations. 3. All handling and disposal of sediments shall be performed in accordance with the WDR issued by the RWQCB. The sediment shall ultimately be disposed at a permitted landfill. Any alternative use or disposal will require RWQCB approval.	All
6.4	Vehicle and Equipment Fueling	No fueling shall be done in the stream channel or immediate floodplain, unless equipment stationed in these locations is not readily relocated i.e., pumps, generators. For stationary equipment that must be fueled on site, containment will be provided in such a manner that any accidental spill of fuel will not be able to enter the water or contaminate sediments that may come in contact with water. Any equipment that is readily moved out of the channel will not be fueled in the channel or immediate floodplain. All fueling done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation .	All
6.5	Vehicle and Equipment Maintenance	No equipment servicing shall be done in the stream channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated i.e., pumps, generators. 1. Any equipment that can be readily moved out of the channel will not be serviced in the channel or immediate floodplain. 2. Al servicing of equipment done at the job site will provide containment to the degree that any spill will be unable to enter the channel or damage stream vegetation. 3. If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be done in the channel or floodplain. 4. If emergency repairs are required, containment will be provided equivalent to that done for fueling or servicing.	All
6.6	Employee/ Contractor Training	All appropriate District staff and contractors shall receive annual training on Stream Maintenance Program BMPs.	All

7. Cultural Resources **The District will protect cultural resources.**			
BMP	**Title**	**Description**	**Activity**
7.1	Discovery of Cultural Remains or Historic Artifacts	Work in areas where remains or artifacts are found will be restricted or stopped until proper protocols are met. 1. Work at the location of the find will halt immediately within 30 feet of the find. If an archaeologist is not present at the time of the discovery, SCVWD will contact an archaeologist for identification and CEQA evaluation. 2. If the find is not significant, construction can continue. The archaeologist will prepare a brief informal memo/letter that describes and assesses the significance of the resource, including a discussion of the methods used to determine significance for the find. 3. If the find appears significant, the archaeologist will determine if the resource can be avoided and will detail avoidance procedures. 4. If the resource cannot be avoided, the archaeologist will develop within 48 hours an Action Plan to avoid or minimize impacts. The SCVWD field crew will not proceed until the Action Plan is approved by the SCVWD Watershed Manager. 5. The recovery effort will be detailed in a report prepared by the archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. 6. In the event of discovery of human remains, the field crew supervisor shall take immediate steps to secure and protect such remains. 7. The Santa Clara County Coroner shall be notified and informed of the find and of any efforts made to identify the remains as Native American. If the remains are determined to be from a prehistoric Native American, the medical examiner is responsible for contacting the Native American Heritage Commission (NAHC) within 24 hours of notification. The NAHC then designates and notifies within 24 hours a *Most Likely Descendant* (MLD). The MLD has 24 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods. 8. Preservation in situ is the preferred option, and if the District can do this without incurring potential future disturbance, then the MLD will usually recommend no further action. The remains and artifacts will be documented and the find location carefully backfilled to avoid further disturbance. 9. Human remains or cultural items exposed during maintenance that are subject to further disturbance will be exhumed archaeologically at the discretion of the MLD and reburied with the concurrence of the MLD in a place mutually agreed upon by all parties.	All

BMP	Title	Description	Activity
7.2	Review of Projects with Native Soil	A cultural resources specialist will conduct a review and evaluation of those sites that would involve disturbance / excavation of native soil previously undisturbed by contemporary human activities to determine their potential for affecting significant cultural resources. The evaluation of the potential to disturb cultural resources will be based on an initial review of archival information provided by the California Historical Resources System/Northwest Information Center (CHRIS/NWIC) in regard to the project area based on a 0.25 mile search radius. It is recommended that this initial archival review be completed by a professional archaeologist who will be able to view confidential site location data and literature to arrive at a preliminary sensitivity determination. If necessary, a further archival record search and literature review (including a review of the *Sacred Lands Inventory* of the Native American Heritage Commission); and a field inventory of the project area will be conducted to determine the presence/absence of surface cultural materials associated with either prehistoric or historic occupation. The results along with any mitigation and/or management recommendations would be presented in an appropriate report format and include any necessary maps, figures, and correspondence with interested parties. A summary table indicating appropriate management actions (e.g., monitoring during construction, presence/absence testing for subsurface resources; data recovery, etc.) will be developed for each project site reviewed. The management actions will be implemented on site to avoid significant effects to cultural resources.	All

Attachment B
Guidelines for Reduction of Maintenance Activities in Unmodified Streams

ATTACHMENT B

GUIDELINES FOR REDUCTION OF MAINTENANCE ACTIVITIES IN UNMODIFIED STREAMS

Revised: September 28, 2001

I. Purpose

The purpose of this document is to formally define work activities performed in the unmodified streams under the jurisdiction of the Santa Clara Valley Water District. Based on direction from the District's CEO and comments recently received from the United States Fish and Wildlife Service, staff is preparing formal guidelines defining when and how to conduct maintenance activities in unmodified streams. These guidelines will describe general work limitations and creek-specific resources protection measures. The unmodified streams in which work is projected under this program are listed in the attached table "Guidelines for Reduction of Maintenance Activities in Unmodified Streams" at the end of this document. Many are recognized as having significant ecological values which shall be preserved to the maximum extent while balancing the goals and requirements of the District as a resource manager.

II. Program Goals

The goal of this program is to provide the maintenance necessary to meet the District's ends policies and local ordinances and policies while implementing a standard even higher than that of the Stream Maintenance Program. The policies and ordinances that this work complies with include:

Board Ends Policy 1.2	There is reduced potential for flood damages
Board Ends Policy 2.1	Watersheds, streams and the natural resources therein are protected and when appropriate enhanced or restored.
Local Fire Codes	Requires control of combustible weeds and grasses
District Ordinance 83-2	Requires that an owner shall maintain a watercourse such that it does not contribute to pollution, so that it does not unreasonably change or retard the flow of the water and so that it is in a safe condition

III. Program Description

The District has jurisdiction of over 300 miles of unmodified creeks and projects that maintenance activities will occur on approximately 57 miles of them. Approximately 26 miles of the 57 miles have the capacity to contain the 100-year flows which meets the FEMA standard regarding flood insurance requirements and will be maintained to an appropriate standard. Approximately 4 miles of unmodified creeks will be modified as part of the District's Clean, Safe Creeks and Natural Flood Protection Program and are excluded from these guidelines.

As a result, these guidelines will apply to 27 miles of the 57 miles of unmodified streams where maintenance activities will occur. See page 5 of for the definition of unmodified stream for the purposes of this document.

This program will establish the criteria that will define when work is required:

- To provide the appropriate levels of protection to property from flood and fire danger on unmodified streams under District jurisdiction while preserving the environmental values of the streams to the maximum extent practicable.
- To perform corrective maintenance as needed to maintain this protection to the appropriate level, performing such maintenance only when necessary as defined in this document
- To strive to establish self-maintaining stream system where success is measured by the lack of need for in stream work to be performed.

A. Rationale for Performing Work on Unmodified Streams

In general, work will be performed on unmodified streams to:

1. Minimize dead and dry fuel loads for fire protection.
2. Clear debris blockages and downed trees that may cause flooding
3. Clear vegetation from known trouble spots prior to winter storms
4. Respond to concerns from the public or local governments relative to stream conditions

The rationale for performing these activities varies. The first activity is driven by fire code requirements and has specific outcomes defined by these requirements. The next three activities are done to reduce flood damage to the community. This document will help to define the rationale for these activities.

B. General Criteria for Vegetation Management

Reaches of unmodified streams of concern shall be surveyed prior to April 1st of each year by the vegetation planner. In stream areas with vegetation exceeding the established criteria shall be identified at this time. A list of these work areas will be submitted to the Watershed Manager for concurrence that the work is required and that no impacts to fish and wildlife above those projected and addressed in the SMP/EIR will result from the proposed work.

Existing native woody vegetation greater than six inches in diameter (measured at breast height) will be allowed to remain on the stream bottom. Only if the woody vegetation greater than 6 inches in diameter is directing flows at the banks causing excessive bank erosion or if it is causing debris dams which threaten to flood property may they be removed. Woody vegetation of less than six inches in diameter will be removed from channel bottoms to prevent debris dams that may cause flooding or property damage or hinder fish passage. Native woody vegetation shall be encouraged to establish on the banks to provide a natural canopy, maximize habitat, minimize the establishment of vegetative growth in the stream bottom and prevent erosion, in an effort to minimize the need for in stream maintenance.

C. General Criteria for Removal of Woody Debris and Blockages

Removal of woody debris and blockages will be reviewed on a case by case basis by the Watershed Manager. Woody material including stumps, snags, and branches create important fish and wildlife habitat and will be retained unless it threatens a structure, is creating bank erosion, impedes reasonable access or compromises flood protection to the community.

D. General Criteria for Sediment Removal

Sediment will be removed in unmodified creeks only as necessary to provide flood protection or to ensure proper operation of facilities including culverts, bridges and outfalls. Any sediment removal work in unmodified streams will have resource protection measures and best management practices identified and assigned to the work, the work will be reported to agencies in May each year prior to starting the work, site specific requirements and environmental constraints will be reviewed in a pre-work conference, the work will be examined and recommendations documented to improve the work during lessons learned and an evaluation of the resource protection measures provided to implement improved work methods. Each site will be reviewed by a biologist and appropriate site surveys conducted to minimize impacts to water quality, vegetation and native species. Spawning gravels will be restored, low flow fish passage will be maintained, and native aquatic vertebrates will be salvaged. Disturbed areas will be reseeded, trees will be replaced in accordance with the best management practices in the Stream Maintenance Program.

In addition, the Watershed Manager will review and approve each of these jobs, assuring the balance of community flood protection and environmental concerns.

E. Upland Vegetation Management

In upland areas, the District shall continue to meet its requirement to abate combustible weeds within its rights of way on unmodified streams prior to July 1 as required by local fire codes. Details of this activity follow in the next section. Herbicides, mechanical methods and hand removal will be used as the tools to meet this requirement. Use of herbicides shall be reduced relative to historical practices to the maximum practical extent and replaced with alternative methods as defined in this document.

Herbicides used in upland areas of unmodified streams shall be non residual, post emergence herbicides. No pre emergence herbicides will be used. Herbicides applied to target species on stream banks shall be registered for aquatic use.

In upland areas, herbicides shall only be applied to:

- Maintain vehicular access on existing maintenance roads. When such work is performed, herbicide use will be minimized by performing spot applications directly to existing weeds. No broadcast applications will be conducted in unmodified streams. See Reference Figure 1.
- Control non-native, invasive species. Herbicide use shall be minimized through the use of the cut stump treatment method. This work is done to improve creek habitat by providing conditions for native vegetation to establish. See Reference Figure 2.

F. Upland Non chemical Weed Abatement

In areas inaccessible to vehicles, though herbicides could be used, the preferred method shall be non chemical in acknowledgement of the higher environmental values of these less disturbed areas. The requirement for control and removal of combustible weeds in these areas shall be met through the use of hand crews. Work in these areas shall not commence until the end of the rainy season (May 1) and shall be limited to providing adequate defensible space as required by the code through the removal of dry weeds and grasses only. No native shrubs or trees shall be removed through this process unless it is deemed by a fire code officer that such removal is required to comply to the code. By adhering to this practice, grasses are allowed to mature and produce seed for the following season while the fuel load is eliminated prior to the start of fire season. Areas to be cleared shall be surveyed prior to the commencement of work and active nesting areas shall be identified and avoided. Reference Figure 3.

G. In-stream Use of Herbicides

Herbicide use within the banks of a stream shall be limited to the use of aquatic registered herbicides on invasive non native plants within the District's right of way. See Revised Table 2-2, Herbicide Use for the Stream Maintenance Program and Appendix H, Pesticide Literature Review in the Stream Maintenance Program for additional details. Pesticides with an aquatic species hazards class will not be applied in currently occupied habitat or within 200 yards (air application) or 40 yards (ground application) of habitat.

Minimization of use of herbicides and avoidance of impacts to non target plants shall be ensured by limiting herbicide applications to the treatment of cut stumps of the target species.

No herbicide applications shall be made within 48 hours of expected rainfall to minimize movement of the product off of the treated area.

See Figure 4 for typical cross section and limits of work.

IV. Definitions

A. Definition of Unmodified Streams

An unmodified stream is defined for the purposes of this document as a creek, river, or section thereof, which has not undergone the process of construction of modifications to meet specific flood control criteria. Examples of such criteria would include design to pass specific flows, such as a 25-year flood, or the protection of a specific number of homes, businesses, schools, etc. Further, (1) reaches of unmodified streams which meet FEMA standards regarding flood insurance requirements (i.e. has been analyzed to have the capacity to contain the 100-year flood as inventoried in the District's Waterways Management Model) and (2) reaches of unmodified streams that are part of capital improvement projects under the Clean, Safe Creeks and Natural Flood Protection Program are excluded from these guidelines and will be maintained to an appropriate standard.

An unmodified stream may be in its natural state, or may have had minor modifications, such as small bank protection projects, grade control structures, or minor realignments from past uses such as agriculture.

B. Definition of Work Areas

Upland areas are defined for the purposes of this document as any areas above the stream bottom.

Specific areas for work activities in upland areas include

- Areas outside of the banks of the channel for terrestrial herbicide applications as shown in Figure 1, e.g. maintenance access roads.
- From the top of bank to halfway down the stream bank, as shown in Figure 2, for mechanical abatement of weeds for fire protection
- Areas requiring cleanup of debris, blockages and downed trees

In-stream areas are defined for the purposes of this document as the cross sectional area of a stream between toe of bank and toe of bank, as shown in the typical cross section in Figure 4. In-stream work activities include vegetation management, sediment removal, and cleanup of debris, blockages and downed trees.

Projected work areas are listed in the attached table, *"Project Work Areas for Maintenance Under Guidelines for Maintenance Activities in Unmodified Streams,"* and are further described in the Stream Maintenance Program document, Chapter 1, Paragraph B.

C. Definition of Vegetation Terms

Aquatic vegetation is that herbaceous vegetation that grows in the wetted channel bottom and is typically dependent on either sustained flow or prolonged periods of water on site for survival.

Herbaceous vegetation consists of flexible, non-woody vegetation which includes grasses, broadleaf weeds, cattails, tules and some shrubs.

Woody vegetation is characterized as live vegetation having a stiff trunk or branch structure that is inflexible and does not bend over in flows. Typical vegetation types include trees and some large shrubs. This vegetation may be removed if capacity is compromised or the vegetation is causing erosion to adjacent stream banks or structures.

Non-native vegetation is defined as vegetation that is not naturally found in riparian or wetland ecosystems. These species may be removed by the District because their invasive nature typically reduces native vegetation cover and degrades natural habitat. Species include giant reed, tree tobacco, castor bean, pampas grass, eucalyptus and acacia.

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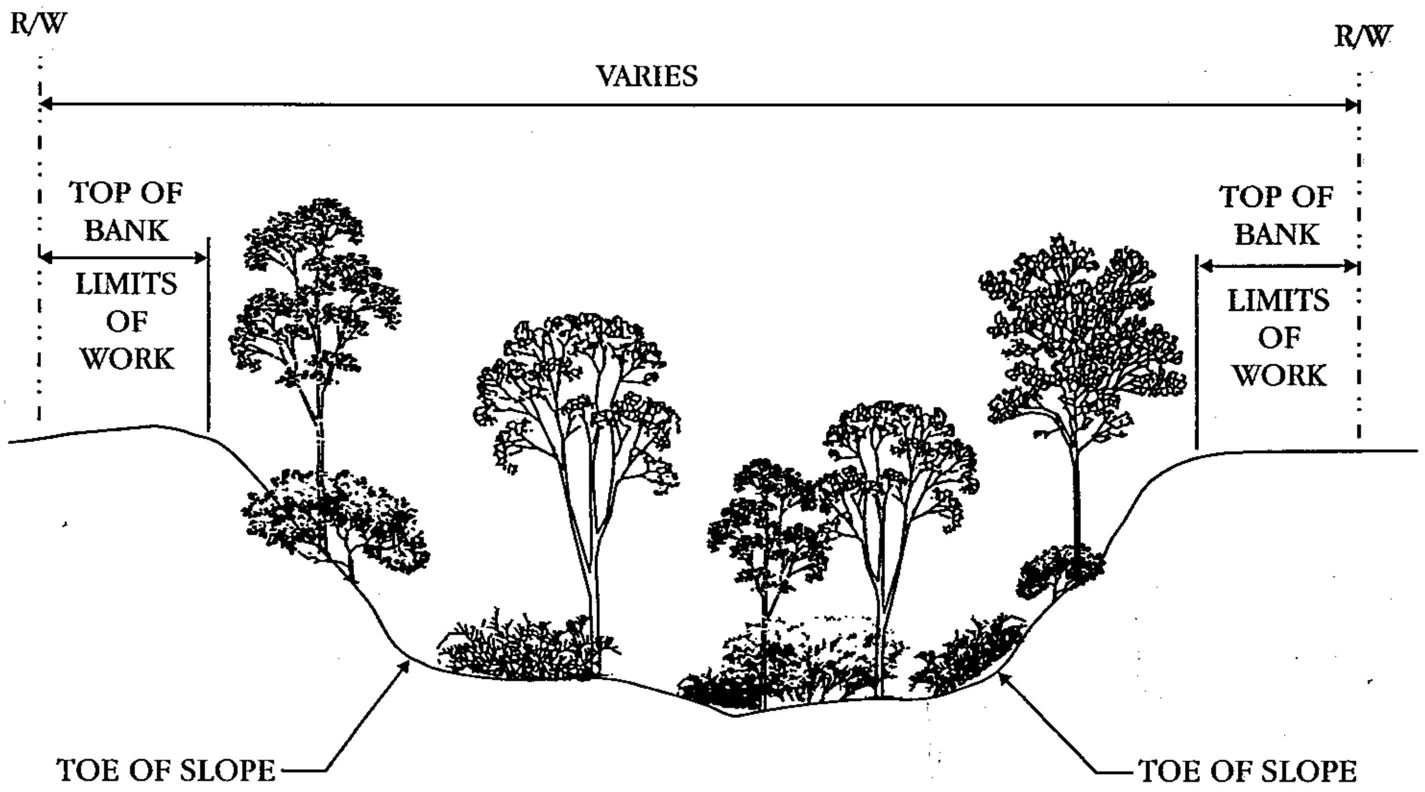

Vegetation Control
Upland Herbicide Work
Spot Applications Directly to
Target Weeds on Maintenance Roads
Figure 1

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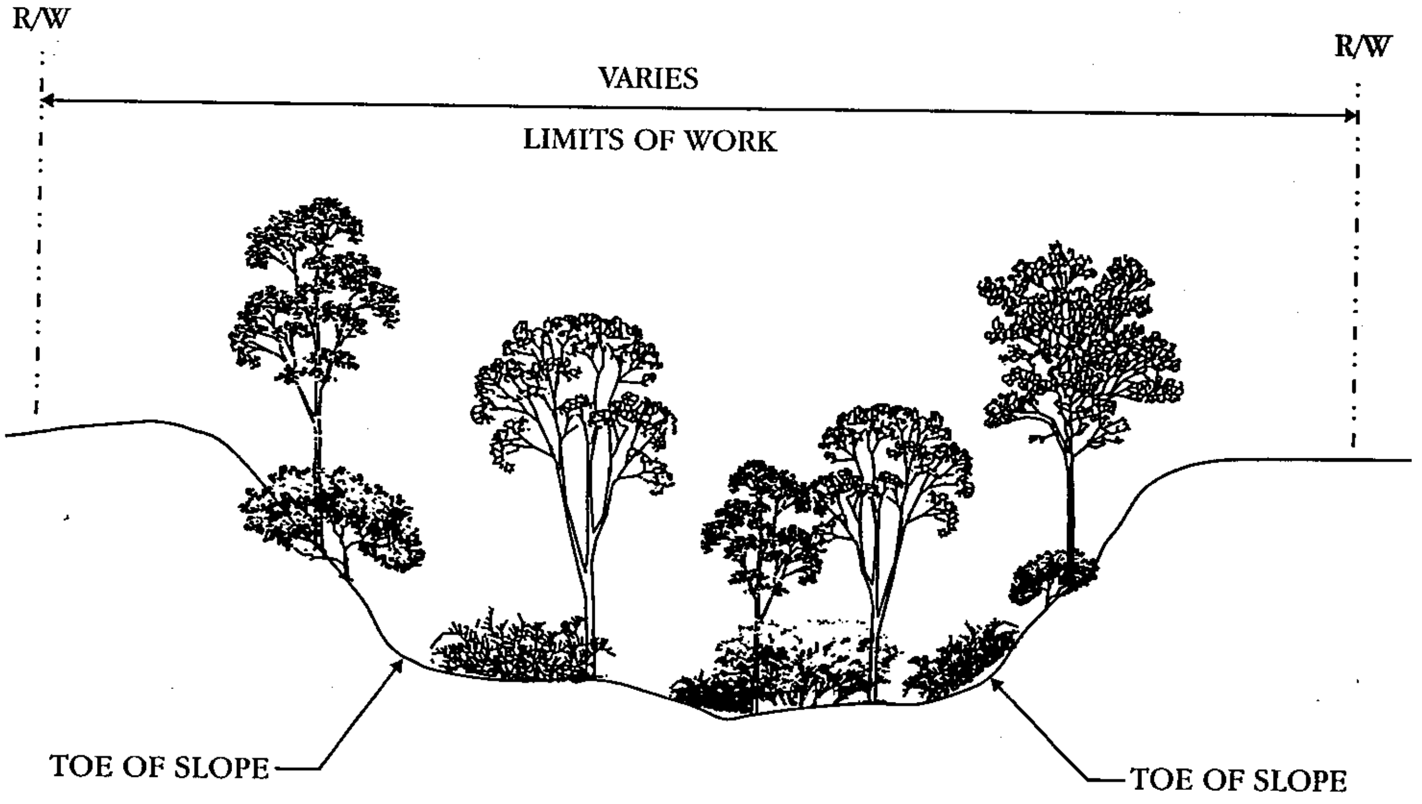
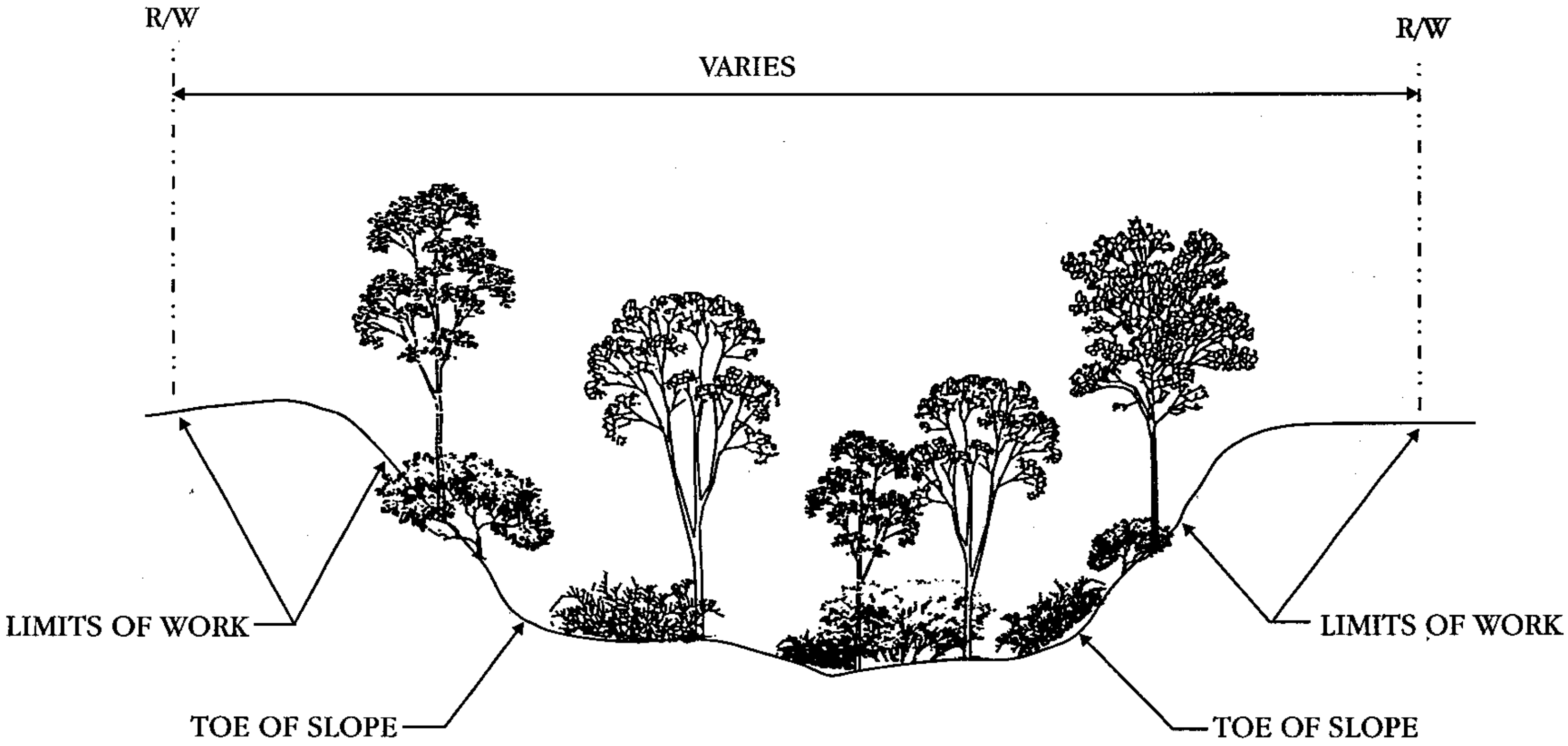


Vegetation Control

Removal of Non-native Vegetation

Non-natives include: Giant Reed, Tree Tobacco,
Castor Bean, Pampas Grass, Eucalyptus,
Acacia, Tree of Heaven, and Tamarisk

Figure 2



Vegetation Control
Upland Areas
Hand Removal for Weed
Abatement to Meet Fire Codes
Work to be Performed after June 1
Following a Completed Nesting Survey
Figure 3

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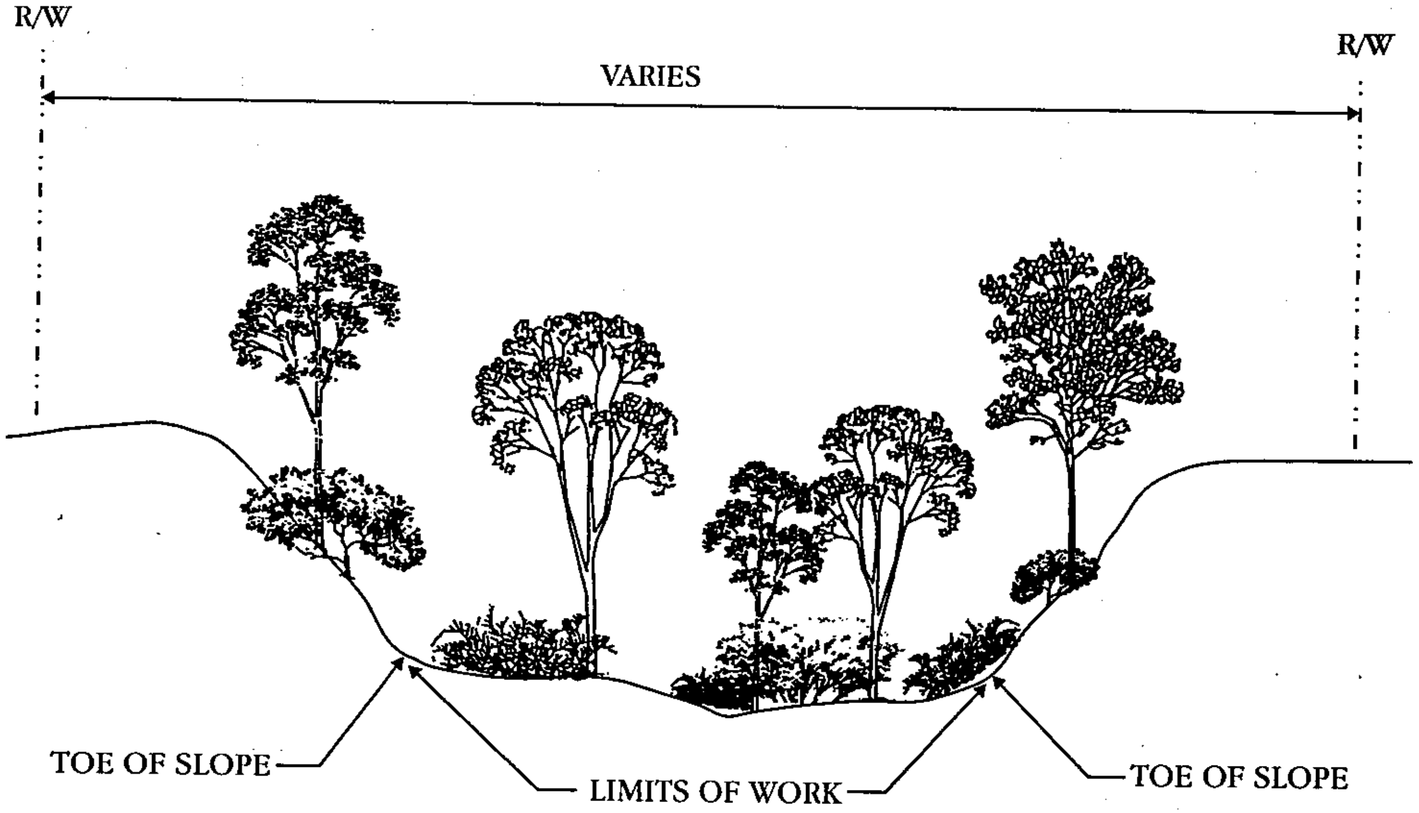

Vegetation Control
In-Stream
Non-native and Woody Growth
Less than Six Inches in Diameter
Work Is Typically Performed in
10 to 25 Percent of Channel Bottom
Figure 4

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PROJECTED WORK AREAS FOR MAINTENANCE UNDER GUIDELINES FOR MAINTENANCE ACTIVITIES IN UNMODIFIED STREAMS

Fac No.	Creek	Activity	From Sta	To Sta	Length - One-Time (ft)	Bottom Width (ft)	Work Footprint One Time (ac)	% Work Area for Veg	Treated Area One-Time for Veg (ac)	Vol One Time for Sediment Removal (cy)
1010	ADOBE	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	250+00	258+00	800	11	0.1	10%	0.0	
1010	ADOBE	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	513+35	535+00	2,165	10	0.5	10%	0.0	
1029	STEVENS	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	198+50	205+80	730	25	0.4	10%	0.0	
2010	CALABAZAS	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	690+00	693+00	300	16	0.1	20%	0.0	
2018	RODEO	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	0+00	1+85	185	10	0.0	25%	0.0	
2018	RODEO	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	90+70	100+00	930	7	0.1	25%	0.0	
3010	ALAMITOS	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	96+00	100+00	400	43	0.4	25%	0.1	
3010	ALAMITOS	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	100+00	230+00	13,000	40	11.9	25%	3.0	
3012	CALERO	WOODY/AQUATIC VEG. REM. HAND LABOR-INSTREAM	0+00	130+00	13,000	10	3.0	25%	0.7	
3012	CALERO	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	130+00	160+00	3,000	8	0.6	25%	0.1	
3020	LOS GATOS	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	0+00	18+00	1,800	45	1.9	10%	0.2	

PROJECTED WORK AREAS FOR MAINTENANCE UNDER GUIDELINES
FOR
MAINTENANCE ACTIVITIES IN UNMODIFIED STREAMS

Fac No.	Creek	Activity	From Sta	To Sta	Length - One-Time (ft)	Bottom Width (ft)	Work Footprint One Time (ac)	% Work Area for Veg	Treated Area One-Time for Veg (ac)	Vol One Time for Sediment Removal (cy)
3029	RANDOL	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	89+00	101+00	1,200	9	0.3	25%	0.1	
4021	COYOTE	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	1560+00	1580+00	2,000	90	4.1	10%	0.4	
4029	MIGUELITA	WOODY/AQUATIC VEG. REM. HAND LABOR-INSTREAM	160+00	162+00	200	5	0.0	25%	0.0	
4032	UPPER PENITENCIA	WOODY VEG. REM. HAND LABOR-INSTREAM	0+00	35+00	3,500	8	0.6	20%	0.1	
4032	UPPER PENITENCIA	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	170+00	210+00	4,000	15	1.4	10%	0.1	
4038	UPPER SILVER	SEDIMENT REMOVAL	75+00	85+00	1,000.0	3	0.1			74
4038	UPPER SILVER	SEDIMENT REMOVAL	85+00	90+00	500.0	6	0.1			75
4047	THOMPSON	WOODY VEG. REM. HAND LABOR-INSTREAM	71+00	72+59	159	15	0.1	10%	0.0	
4049	EAST PENITENCIA	WOODY & AQUATIC VEGETATION REMOVAL HAND LABOR INSTREAM	23+50	36+00	1,250	12	0.3	25%	0.1	
5010	LLAGAS	WOODY VEG. REM. HAND LABOR-INSTREAM	524+00	1015+00	49,100	80	90.2	10%	9.0	
5018	UVAS-CARNADERO	WOODY VEG. REM. HAND LABOR-INSTREAM	146+00	360+00	21,400	70	34.4	10%	3.4	
5018	UVAS-CARNADERO	WOODY VEG. REM. HAND LABOR-INSTREAM	360+00	485+00	12,500	70	20.1	10%	2.0	

PROJECTED WORK AREAS FOR MAINTENANCE UNDER GUIDELINES
FOR
MAINTENANCE ACTIVITIES IN UNMODIFIED STREAMS

Fac No.	Creek	Activity	From Sta	To Sta	Length - One-Time (ft)	Bottom Width (ft)	Work Footprint One Time (ac)	% Work Area for Veg	Treated Area One-Time for Veg (ac)	Vol One Time for Sediment Removal (cy)
5021	CORRALITOS	WOODY VEG. REM. HAND LABOR-INSTREAM	0+00	10+00	1,000	20	0.5	25%	0.1	
5033	SAN MARTIN	SEDIMENT REMOVAL	28+00	80+00	5,200.0	5	0.6			500
5033	SAN MARTIN	SEDIMENT REMOVAL	80+00	96+10	1,610.0	5	0.2			500

PROJECTED WORK TOTALS: **27 miles** **20 acres**

Note: The areas projected for work under the Guidelines for Maintenance Activities in Unmodified Streams were obtained from an overlay of the District's projected work areas with the WWMM inventory of unmodified streams. In conformance with the guidelines, unmodified streams with 100 year capacity and those to be modified by a CIP in the next 15 years are excluded.

Attachment C
Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities

Attachment C

Santa Clara Valley Water District

Stream Maintenance Program Programmatic Impact Assessment and Mitigation for Routine Bank Protection Activities

July 18, 2001

1.0 OVERVIEW

Bank protection involves any action by the District to repair stream banks that are eroding as well as to prevent bank erosion. The District may implement stream bank repair when the continuing stream degradation: (1) causes or could cause significant damage to a property or adjacent property, (2) is a public safety concern, (3) adversely affects transportation or recreational use, (4) adversely impacts beneficial uses of surface water, or (5) adversely affects riparian habitat. Bank protection also includes preventive maintenance to ensure that banks do not erode in the future. Such erosion protection reduces sedimentation and improves water quality.

The District uses a wide range of bank protection techniques. Repairs can take several forms, ranging from the use of soft structures (i.e., willow brush mattresses, log crib walls, pole plantings) to the installation of hard structures (i.e., rock blanket, concrete, sack concrete, gabions) or combination of hard and soft structures.

Riparian corridors in Santa Clara County provide a remarkable range of biological functions. These functions range from fish and other aquatic habitat in the streams themselves to foraging and nesting habitat for birds in the woodland canopy above to movement corridors for numerous terrestrial species. Bank protection activities may alter the biological resource values of the stream environment by changing the conditions in the stream itself or by changing the vegetation surrounding the stream.

The Stream Maintenance Program (SMP) provides for routine bank protection activities throughout the District's jurisdiction. The SMP incorporates a programmatic impact assessment and mitigation for routine bank protection activities that is intended to meet the majority of concerns for the function of aquatic and riparian habitats in the streams. This programmatic assessment will be supplemented by other DEIR sections that describe specific potential impacts to water quality, listed species, etc., from bank protection and other SMP components and provide the numerous (BMPs) that address those impacts.

2.0 BANK PROTECTION WORK

Based on 13-year historical records, the District estimates that an average of roughly one linear mile of stream banks may be repaired annually. Many repair sites are small and are not easily predicted. The quantity and location of bank protection activities varies greatly from year to year, based on watershed conditions (heavy rains often lead to more work in the following year), degree of safety hazard, work load, budget, and quantity of other priority work to be done in a given year. The description of historical bank protection in the SMP shows that a greater concentration of bank protection occurs in cities and semi-rural foothills of the Santa Clara Valley. Actual future bank protection work could potentially be done anywhere it is needed within District jurisdiction.

Many areas receiving bank protection are void of native riparian vegetation as a consequence of erosion. Nevertheless, over the 20-year life of this proposed program, some 20 miles of the approximately 1650 miles of bank under District jurisdiction can be expected to be modified, and some increment of existing riparian vegetation can be expected to be lost. Soft erosion control methods are not always adequate to protect life and property. Therefore, some portion of that 20 miles will be protected with hardscape methods, and riparian vegetation may be precluded from reestablishing. Under the Stream Maintenance Program, the District has committed to installing no more than 50% of the bank protection work using impervious hardscape designs.

The general design criteria and cross-section for each of the bank protection methods used by the District are included in this appendix . In addition to those criteria, design of a particular bank protection project includes evaluation of other site specific characteristics, such as location (for example, the inside of or outside of a curve), soil type, shear stress, features of the channel adjacent to the site and available right of way. Figure E-1 is a flow diagram of the bank protection alternatives selection process.

3.0 CLASSIFICATION OF RESOURCES, TECHNIQUES, IMPACTS, AND REVEGETATION POTENTIAL

This programmatic impact assessment and the accompanying mitigation rely on several simple classifications of the biological species, stream functions and biotic resources impacted, the bank protection techniques utilized, and the potential for site revegetation. Obviously conditions vary widely from stream to stream and even over short distances within a stream. The intent in these classifications is to represent the typical conditions and to allow site assessment to verify the actual conditions and the suitability of the measures to be applied.

3.1 Species

As described in the Environmental Setting section, healthy riparian habitat is critical to maintaining biological diversity in areas such as Santa Clara County, where upland habitat has been intensively modified for agricultural and urban uses. Biological species potentially impacted include strictly aquatic species, such as fish, strictly terrestrial (upland) species, such as songbirds, and numerous species that move between the aquatic and adjacent upland habitat, such as frogs. Qualitatively, the aquatic species of greatest concern is the federally listed steelhead. Other aquatic species of concern include land-locked rainbow trout, chinook salmon, and other native fish. The terrestrial species of particular concern include birds, especially neotropical migrants and raptors. Impacts to the semi-aquatic reptiles and amphibians, such as California red-legged frogs and western pond turtles, are of potential concern in both aquatic and terrestrial habitat.

3.2 Stream Functions

Stream functions potentially affected by bank protection are classified as either in-stream functions primarily affecting the aquatic environment or stream side functions primarily affecting the riparian environment, but also affecting the aquatic environment. Note that other in-stream functions generally not impacted by bank protection, such as steelhead spawning habitat, are also addressed in the DEIR. For in-stream functions, conditions beneficial for native fish are of paramount importance. The following discussion oversimplifies the aquatic species habitat relationship, but is a reasonable guide for application of programmatic mitigation.

3.2.1 In-stream

In-stream functions provided in or immediately adjacent to the normal flow channel directly serve aquatic and semi-aquatic species. For the programmatic mitigation, the channel is defined to be the area below Ordinary High Water. Functions include:

1. In stream Escape Cover: provided by undercut banks, large boulders, tree roots, downed trees, and other structural elements (including deteriorating bank protection projects)
2. Hydraulic Complexity: resulting from the interaction of current with the same structural elements providing instream escape cover
3. Velocity Refuge: also provided by structural elements
4. Shading and water temperature moderation: provided by mature riparian shrubs and trees
5. Overhanging escape cover: provided by shrubs and grasses near the stream edge

3.2.2 Stream-side

The stream-side environment includes the functions of riparian vegetation. This upland vegetation benefits terrestrial species, as well as semi-aquatic amphibians and reptiles and fish. Functions include:

1. Sediment stabilization: provided by riparian trees, shrubs and grasses
2. Shading and water temperature moderation: provided by mature riparian shrubs and trees
3. Overhanging escape cover: provided by shrubs and grasses near the stream edge
4. Bird breeding and foraging habitat: provided by mature native riparian species, such as cottonwoods and willows, oaks, other trees, shrubs, forbs, grasses, and the streambank itself
5. Foraging, refugia, estivation, and breeding habitat for semi-aquatic amphibian and reptile species: provided by low vegetation, rocks, downed materials, and the streambanks itself
6. Foraging, breeding, hibernacula, and dispersal habitat for mammals: provided by the riparian vegetation and the streambanks, substrate

3.3 Bank Protection Techniques

Bank protection methods are classified here by their impact on (1) in-stream habitat and (2) stream-side habitat. For each habitat type, there are three categories of effects: those that (1) enhance biotic resources, (2) provide limited biotic resource, or (3) reduce or eliminate biotic potential. The Bank

Protection Impact Assessment Matrix allow evaluation of the direct and potential impacts of bank protection. This appendix includes the descriptions and drawings for approximately 30 methods of bank protection and an evaluation of the impact for in-stream and stream-side habitat. The appendix will be updated as new methods or criteria are added to the program.

4.0 IMPACT AND MITIGATION

The District proposes to implement a bank protection program that avoids impacts to the greatest extent possible and incorporates mitigation to balance impacts that can not be avoided. The impact of bank protection depends on the type of work done and the sensitivity of the environment where the work is done. This work type/environment relationship is reflected in the Impact Assessment matrix which follows section 4.3 of this appendix for in-stream and stream-side resource functions. The matrix identifies project effects as "Neutral", "Impact", or "Benefit", and in some cases, "Not covered by SMP".

Neutral. A project effect is said to be neutral when the environmental effect of a bank protection measure results in neither an adverse impact nor a significant net benefit to the existing environment.

Impact. A project effect is said to be an impact when the environmental effect of a bank protection measure results in an adverse impact to the existing environment.

Benefit. A project effect is said to be a benefit when the environmental effect of a bank protection measure results in a significant net benefit to the existing environment. This benefit can be used to offset or mitigate adverse impacts elsewhere.

Not Covered by the SMP. In some cases, the environment is judged to have a high environmental sensitivity and certain bank protection techniques would have a significant irreversible and cumulative effect that cannot be effectively mitigated by enhancing conditions elsewhere. Such projects are deemed to be outside of the scope of the routine maintenance in the SMP. Also excluded is emergency work.

4.1 In-stream Impacts

In-stream environmental quality is primarily determined by fisheries present. Other mitigation is proposed elsewhere for impacts on other protected aquatic species such as red-legged frog. Most District streams have been categorized by fisheries present.

High Sensitivity *Fisheries*. Cold water fishery with trout or steelhead, warm water fishery with trout potential (DEIR fish habitat categories 5, 6, and 7).

Medium Sensitivity *Fisheries*. Warm water native fishery, salmon present (DEIR fish habitat categories 3 and 4) or any reach used for steelhead migration.

Low Sensitivity *Fisheries*. Warm water fishery, mostly introduced species, fish limited or no value (DEIR fish habitat categories 0,1 and 2), but only where the reach is not used for steelhead migration).

4.2 Stream-side Impacts

Simply, the impact of bank protection on stream-side functions can be evaluated based upon the quality of the riparian habitat impacted and the potential for the site to be revegetated, based on the bank protection work being done. Although the primary Work Measure is lineal extent of stream channel (lineal feet), riparian value will also need to take into account the area affected (square feet) and the number of stems for large vegetation. See BMP 2.8, Replace Trees.

4.2.1 Riparian Habitat Quality

The riparian quality can be classified as:

High Quality Riparian Habitat. Sites with native overstory with continuous understory or occurring in dense thickets; dense native overstory with sparse, non-native or no understory; and native willow thickets. Site may provide overhanging escape cover and shading.
Medium Quality Riparian Habitat. Sites with sparse native overstory with sparse, non-native or no understory; non-native overstory with native understory; and dense nonnative overstory with sparse, non-native or no understory. Site may provide some overhanging escape cover and shading.

Low Quality Riparian Habitat. Sites with no or only sparse non-native overstory with sparse, non-native, or no understory. Site may provide some overhanging escape cover for fish.

4.2.2 Riparian Restoration Potential

Ideally, all bank protection projects would be revegetated to restore full natural potential values. There are practical limitations, however. First, creeks are often in a highly disturbed state with much of the natural system already absent. Second, the need to stabilize over-steepened banks or to withstand very high water velocities may preclude reliance on revegetation alone for bank protection. Third, the banks may be so steep and incised that they do not provide space for riparian vegetation. Fourth, the engineered bank itself may involve impervious surface or such heavily compacted earth that some normal stream side vegetation cannot become established and thrive. Rather than specify impact according to the type of bank protection technique, stream-side impacts are characterized by the potential for restoration, taking in to account the technique and the site limitations.

High Riparian Restoration Potential. Sites where dense native overstory and dense native understory, including willow thickets where appropriate, can be readily established. Overhanging escape cover and shading can be incorporated.

Moderate Riparian Restoration Potential. Sites where sparse native overstory with moderate to dense native understory can be established. Overhanging escape cover and shading may potentially be incorporated.

Low Riparian Restoration Potential. Sites where no or only sparse native overstory and no or only sparse native understory can be established.

4.3 Mitigation for Bank Protection

Using the bank protection impact assessment matrix to evaluate the environmental impact of bank protection, the District proposes a mitigation ratio of 1:1 by area for impacts or credit according to the assessment in the matrix. In-stream and stream-side impacts are evaluated separately and mitigation or credit are applied to each category. To further reduce the adverse effects of bank protection, the District will mitigate for all impacts for impervious hardscape and for unvegetated rock bank protection at a ratio of 3:1 and for all vegetated rock at a ratio of 1:1 regardless of the determination of the impact assessment matrix. This will account for all direct, potential and cumulative impacts from the bank protection program. All impacts and credits will be measured by area and the ongoing totals will be reported in the annual report. Mitigation for both in-stream and stream-side impacts will consist of revegetation consistent with the Protocol for Revegetation Associated with Use of Impervious Materials for Bank Protection in this appendix.

PROTOCOL FOR REVEGETATION ASSOCIATED WITH BANK PROTECTION

Introduction

The purpose of this document is to provide a protocol for developing the revegetation element used in bank protection.

This revegetation protocol contains the following components:
- Location of Plantings
- Plant Selection Criteria
- Planting Techniques
- Establishment Maintenance
- Monitoring/Reporting

This protocol provides the criteria and techniques used in the revegetation element of certain bank protection projects. The methods for revegetation are similar whether the material is being installed on site to reduce environmental impacts or is being installed off site as mitigation for impacts.

Location of Plantings

For overall watershed integrity, it is most desirable to plant at the site of the actual impacts. The site will be evaluated, pre and post project, for ecological and horticultural viability to assure that it can successfully support riparian vegetation. Adjacent areas will be surveyed to determine what types of vegetation a particular creek supports and what limitations may exist for plant establishment.

Vegetation will be planted as near the low flow channel as possible to provide maximum environmental benefit. On repairs where vegetated rock or wood is designed at the toe of the slope, the vegetation will be planted just above the structure. Where design criteria permits, space is available and the hydrology is appropriate, cuttings or small container plantings will be installed into the structure.

For a site to be suitable, it must have ecological, hydraulic, and geomorphic characteristics that give a high degree of certainty for successful revegetation. Design elements that will allow planting will be incorporated into the bank repair if there are not engineering constraints.

In some instances, planting at the actual repair site may not be practical or sustainable. Those situations are referred to in portions of the bank stabilization section of this document. When an alternative site must be selected, it will be selected using the following criteria in descending order of desirability:

- Immediately upstream or downstream of the impact site.
- On the same creek as the impact site.
- In the same watershed as the impact site.
- In an adjacent watershed to the impact site.
- In another riparian area in the same part of the county.
- Within the county.

Once an appropriate location has been selected, all other planting guidelines will apply to the site.

Plant Selection Criteria

The criteria for plant selection will be developed based on surveys of natural areas on the same creek that have a similar ecological setting. These "reference sites" will provide information as to what species would be found in the area and an approximate population density. These areas may also provide propagation materials for the repair site. The stream reaches in valley floor of Santa Clara County have a fairly narrow palette of plant species but reference sites will allow further refinement of the project design to improve the potential for success.

If the District is unable to find appropriate reference sites on the same stream, other areas in the county that have similar ecological conditions will be used as a design reference.

Planting Techniques

Planting techniques for bank stabilization projects will use standard revegetation methods. The following general guidelines will be incorporated into these projects:

- Container stock, seed, or vegetative cuttings will be installed using hand tools or mechanical augers.
- Planting will be done using spacing and a species mix designed to mimic a natural system.
- Designs will incorporate both trees and shrubs to provide habitat complexity.
- While an area may be slightly over-planted to allow for some mortality, densities will not be increased substantially.
- Trees will be planted at an average 12-15' on center and shrubs will be planted at average 6-8' on center.
- Plants will be installed throughout the repair site where conditions allow. Impediments would be soil conditions, impervious substrate, channel capacity issues, and maintenance access.
- Plants will be installed as close to the water as possible. Plantings will not be installed solely at the top of bank.
- Plant material will be from local stock and, when possible, watershed-specific.
- Planting will be done in Fall or early Winter to take advantage of seasonal rainfall to aid establishment.
- Bank stabilization sites will not have an irrigation system per se, but infrastructure to facilitate establishment irrigation will be designed into the project. This could take the form of basins for hand watering, Dri-Water, or other similar measures.

Establishment Maintenance

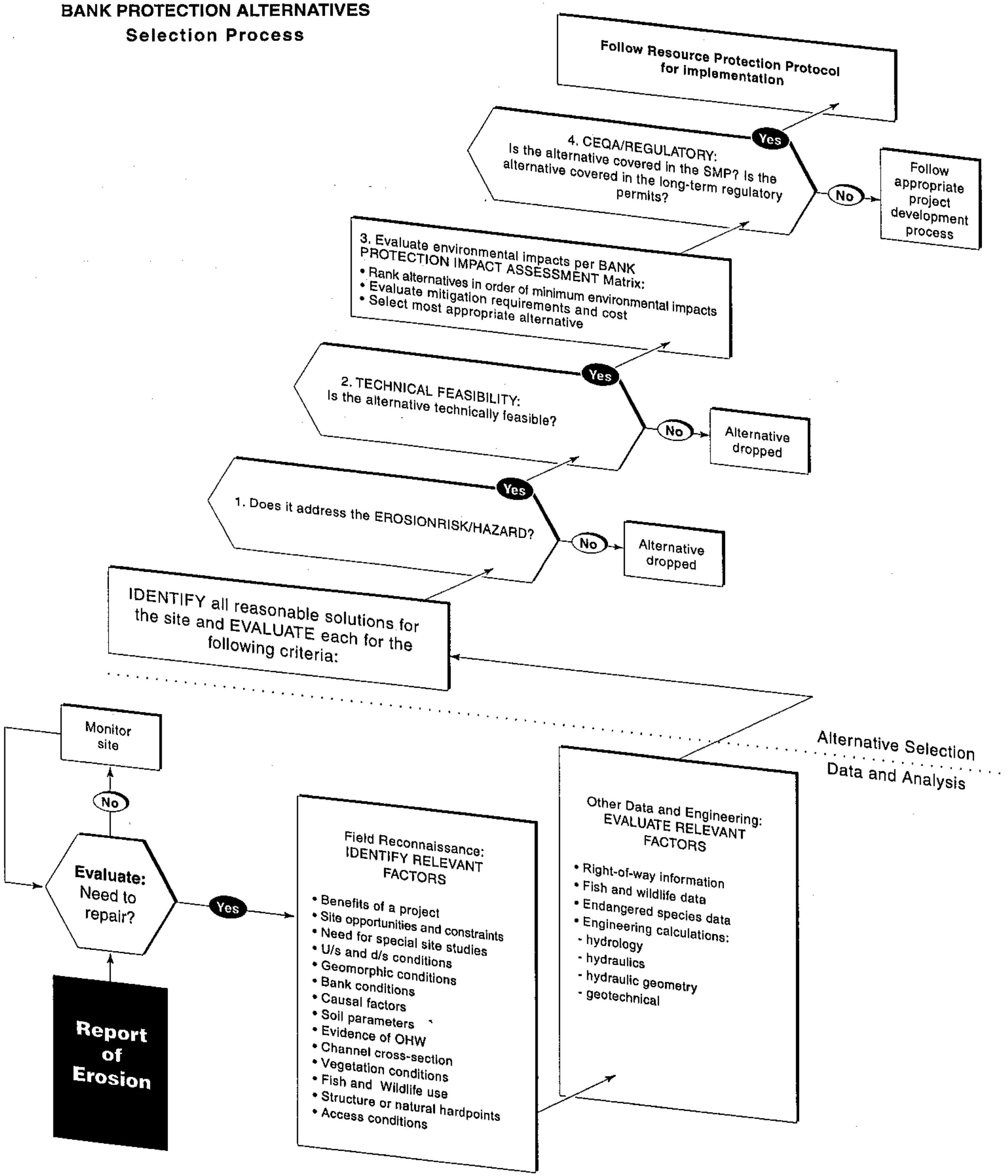
Revegetation on bank stabilization project will have an establishment maintenance period of a minimum of two years. Limited maintenance will continue after the initial two years if project needs warrant these activities. Maintenance will consist of supplemental watering, weed control, rodent control, protection from vandalism, and regular inspections. Replanting will only be done if significant numbers of plants die or are damaged by flows during the establishment maintenance period. The goal of the planting is to get adequate habitat established at each project site.

Monitoring/Reporting

Monitoring for bank stabilization planting projects will consist of regular inspections of all planted sites that are under maintenance. The results of these inspections will be consolidated into a narrative report and included as a section in the annual work report.

Work areas and mitigation efforts will be tracked on an annual basis and reported to the agencies. For the first five years, the District will provide the agencies with a tour after completion of the work season of representative work areas (especially those along target streams) for that year and all mitigation sites. Pre-construction photographs will be provided.

BANK PROTECTION ALTERNATIVES
Selection Process


Report of Erosion
Evaluate: Need to repair?
No
Monitor site
Yes
Field Reconnaissance: IDENTIFY RELEVANT FACTORS
• Benefits of a project
• Site opportunities and constraints
• Need for special site studies
• U/s and d/s conditions
• Geomorphic conditions
• Bank conditions
• Causal factors
• Soil parameters
• Evidence of OHW
• Channel cross-section
• Vegetation conditions
• Fish and Wildlife use
• Structure or natural hardpoints
• Access conditions
Other Data and Engineering: EVALUATE RELEVANT FACTORS
• Right-of-way information
• Fish and wildlife data
• Endangered species data
• Engineering calculations:
- hydrology
- hydraulics
- hydraulic geometry
- geotechnical
Alternative Selection
Data and Analysis
IDENTIFY all reasonable solutions for the site and EVALUATE each for the following criteria:
1. Does it address the EROSIONRISK/HAZARD?
No
Alternative dropped
Yes
2. TECHNICAL FEASIBILITY: Is the alternative technically feasible?
No
Alternative dropped
Yes
3. Evaluate environmental impacts per BANK PROTECTION IMPACT ASSESSMENT Matrix:
• Rank alternatives in order of minimum environmental impacts
• Evaluate mitigation requirements and cost
• Select most appropriate alternative
4. CEQA/REGULATORY: Is the alternative covered in the SMP? Is the alternative covered in the long-term regulatory permits?
No
Follow appropriate project development process
Yes
Follow Resource Protection Protocol for implementation

Bank Protection Impact Assessment Matrix

In-stream Habitat					Steam-side Habitat				
Existing In-stream Habitat Quality		Effect of Bank Protection Method[1]			Existing Riparian Habitat Quality		Effect of Bank Protection Method[1]		
Fisheries Present on Reach[2]	In-stream Functions at Repair Site[3]	Enhance Biotic Resources	Provide Limited Biotic Resources	Reduce or Eliminate Biotic Potential	Reach[4,5]	Repair Site[5]	Enhance Biotic Resources	Provide Limited Biotic Resources	Reduce or Eliminate Biotic Resources
High Sensitivity	Present	Neutral	Impact	Not covered by SMP	High Quality	High	Neutral	Impact	Not covered by SMP
	Absent	Benefit	Neutral	Not covered by SMP		Medium or Low	Benefit	Neutral	Not covered by SMP
Medium Sensitivity	Present	Neutral	Impact	Impact	Medium Quality	High or Medium	Neutral	Neutral	Impact
	Absent	Benefit	Neutral	Impact		Low	Benefit	Benefit	Impact
Low Sensitivity	Present	Neutral	Neutral	Impact	Low Quality	High or Medium	Neutral	Neutral	Impact
	Absent	Neutral	Neutral	Neutral		Low	Neutral	Neutral	Neutral
Classification of Bank Protection Measures		2, 2A, 3, 3A, 4, 4A, 5A, 6, 8B, 8C, 12, 12A	1, 5, 7A, 8A, 9, 9A, 9B, 10B, 11A	7, 8, 10, 10A, 11, 13, 13A, 14	**Classification of Bank Protection Measures**		2, 2A, 3, 3A, 4, 4A, 5A, 6, 12, 12A	1, 5, 8A, 8B, 8C, 10A, 10B	7, 7A, 8, 9, 9A, 9B, 10, 11, 11A, 13, 13A, 14

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[1] See Stream Maintenance Program, Appendix E, Section 4.0 for description of effects of bank protection method.

[2] See Stream Maintenance Program, Appendix E, Section 4.1 for description of fisheries sensitivity and EIR, Figure IV-B-1, Fisheries Present in Streams within the jurisdiction of the Santa Clara Valley Water District

[3] See Stream Maintenance Program, Appendix E, Section 3.2.1. In-stream functions for aquatic and sem-aquatic species include in-stream escape cover, hydraulic complexity, velocity refuge, shading and water temperature moderation, coarse particulate organic matter and overhanging escape cover.

[4] Within 1,000 feet of repair site.

[5] See Stream Maintenance Program, Appendix E, Section 4.2.1 for the description of Riparian Habitat Quality.

BANK PROTECTION MEASURES

#1	Earth Repair
#2	Live Construction
#2A	Live Construction with Boulder Toe Protection
#3	Contour Wattling
#3A	Contour Wattling with Boulder Toe Protection
#4	Brush Mattress (Brush Layering)
#4A	Brush Mattress (Brush Layering) with Boulder Toe Protection
#5	Surface Matting (Erosion Mats)
#5A	Surface Matting (Erosion Mats) with Boulder Toe Protection
#6	Root Wads and Boulders
#7	Cellular Confinement System
#7A	Cellular Confinement System with Vortex Weirs
#8	Rock Blanket
#8A	Boulder Rip-Rap
#8B	Boulder Rip-Rap with Soil and Revegetation
#8C	Boulder Rip-Rap. with Soil and Revegetation and Vortex Weir
#9	Stepped Gabions
#9A	Stepped Gabions with Planted Area
#9B	Stepped Gabions with Planted Area and Vortex Rock Weirs

BANK PROTECTION MEASURES

#10	Concrete Blocks Bio-technical Slope Protection: Articulated
#10A	Articulated Concrete Blocks with Planted Areas
#10B	Articulated Concrete Blocks with Planting Areas and Vortex Rock Weirs
#11	Concrete Crib Walls
#11A	Concrete Crib Walls with Vortex Rock Weirs
#12	Live Log Crib Walls
#12A	Live Log Crib Walls with Vortex Rock Weirs
#13	Sacked Concrete
#13A	Sacked Concrete with Vortex Rock Weirs
#14	Gunite Slope Protection

Bank Protection Measures

#1: Earth Repair

Description:

Earth repair involves the replacement and repair of eroded channel banks using compacted soil. The eroded slope is scarified and readied for fill placement. A key is cut into the bank. Fill is placed and compacted to 90% in 8-inch lifts. The new slope is trimmed to a 2:1 slope. The surface is seeded with fast sprouting grass species like rye.

The fill material needs to be appropriate to this purpose. There should be no deleterious or organic material or other debris contained in the fill. The Atterberg Plasticity Index of the material should be between 15 and 25, with the Liquid Limit no higher than 40. The material must contain at least 20 percent clay (by weight) passing U.S. standard sieve number 200. The fill must be placed in 8-inch or less lifts and at a minimum relative compaction of 90%.

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter.

Appropriate for local stream velocities of 6 feet per second or less.

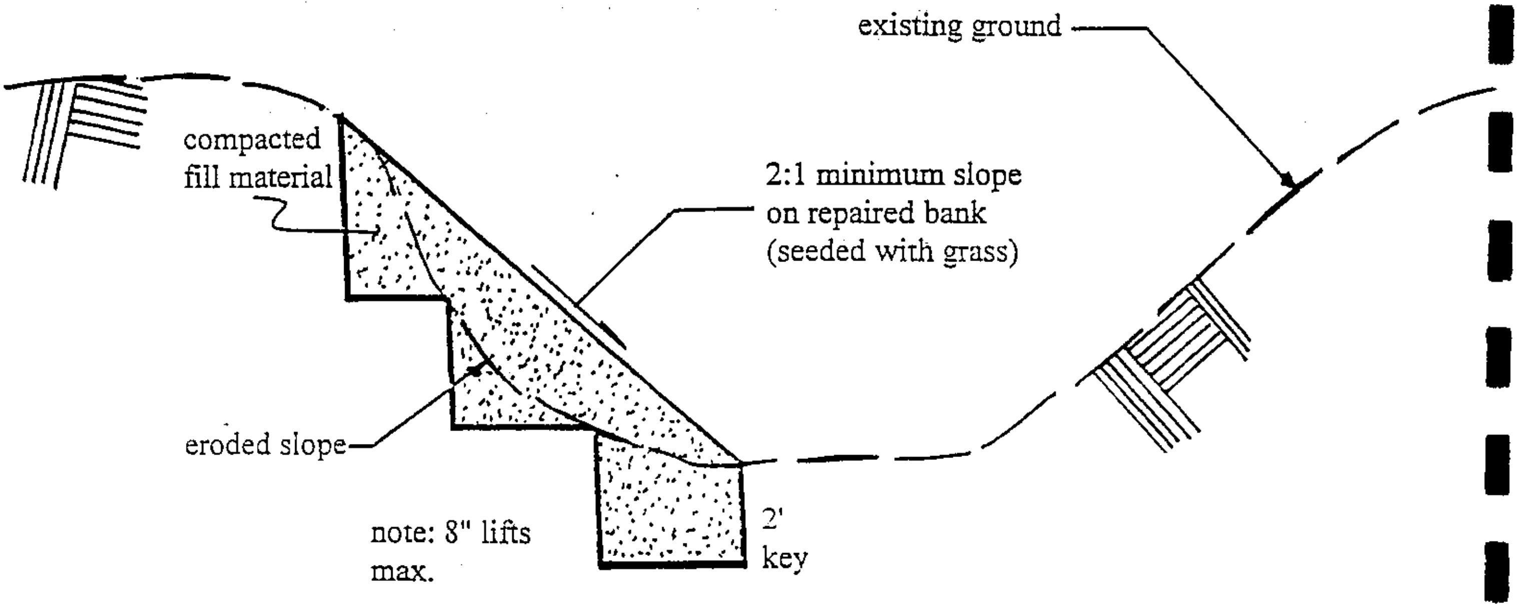
Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Provides limited biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#1: Earth Repair



Section

Bank Protection Measures

#2: Live Construction

Description:

Live construction consists of traditional methods of grading stable slopes and planting live grasses and other plants to control erosion. Vegetation planting methods commonly used include cuttings, transplants, live staking, and direct seeding (including hydro-seeding). Plants are chosen on the basis of drought tolerance and erosion control effectiveness. Biodegradable erosion control materials would be used where necessary in conjunction with live construction to assist in plant establishment.

Excellent revegetation potential. Most successful on streambanks where moderate erosion and channel migration are anticipated. Bank slope, eroding velocity, and reinforcement at the toe of the bank are limiting factors. Enhances conditions for colonization of native species. Streambank soil materials, probable groundwater fluctuation, and bank loading conditions are factors for determining appropriate design[1].

Design Criteria:

Appropriate on bank slopes of 3:1 or flatter.

Appropriate for local stream velocities of 6 feet per second or less.

Soil moisture conditions and availability of water year-around determines appropriate vegetation species (see planting palette).

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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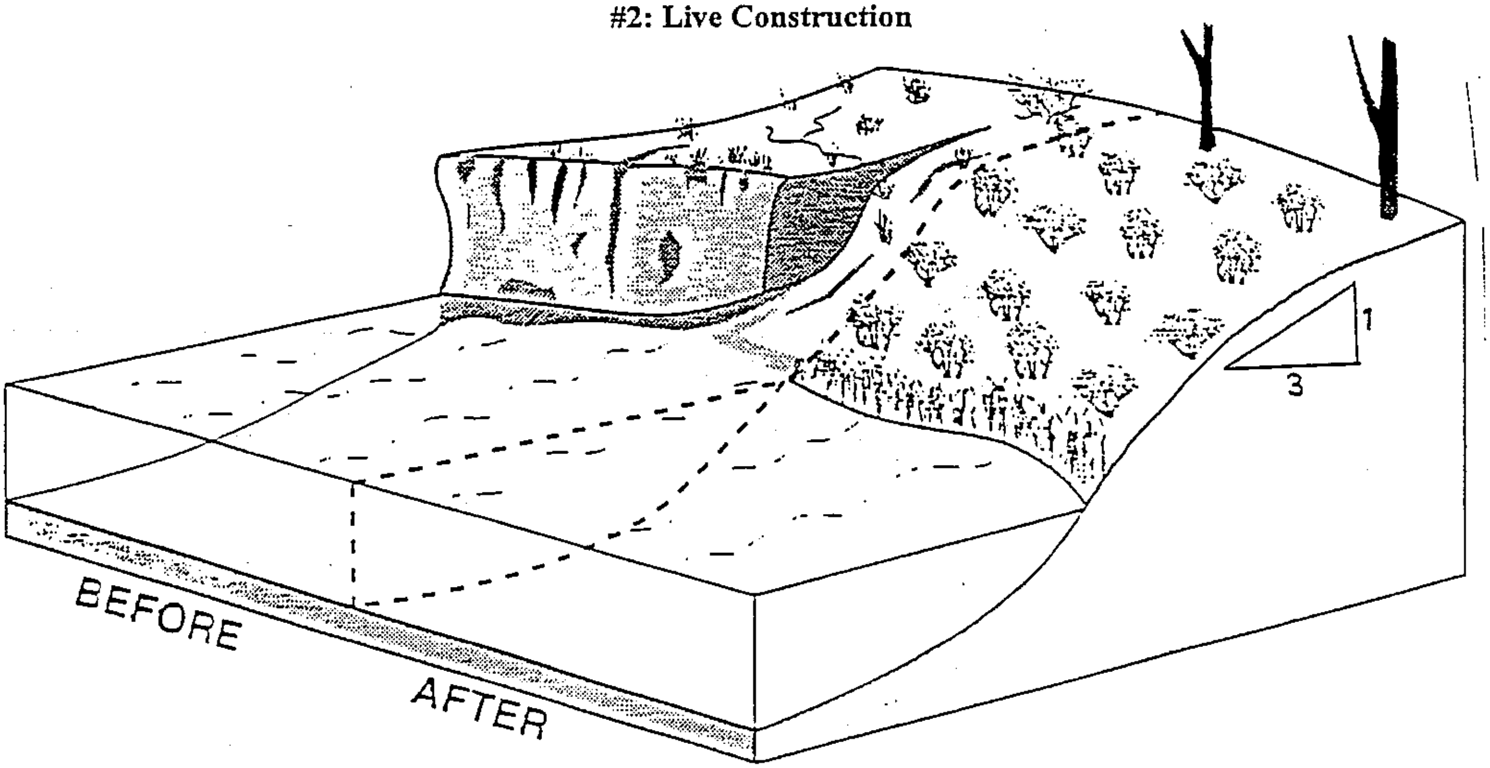
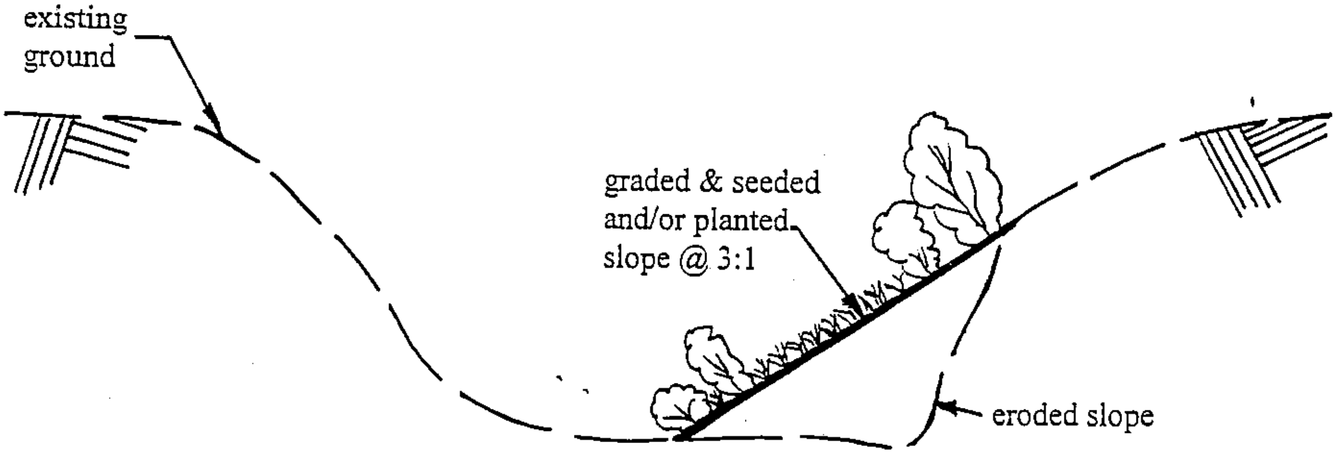
[1] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#2: Live Construction



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices



Section

Bank Protection Measures

#2A: Live Construction with Boulder Toe Protection

Description:

Live construction consists of traditional methods of grading a flatter slope and planting live grasses and other plants to control erosion. Vegetation planting methods commonly used include cuttings, transplants, live staking, and direct seeding (including hydro-seeding). Plants are chosen on the basis of drought tolerance and erosion control effectiveness. Biodegradable erosion control materials are used where necessary in conjunction with live construction to assist in plant establishment.

Boulders (24" to 5 ton) are placed at the toe of the rebuilt bank up to the ordinary high water elevation. Voids in between the boulders can be planted using live stakes[1].

Excellent revegetation potential. Enhances conditions for colonization of native species. Streambank soil materials, probable groundwater fluctuation, and bank loading conditions are factors for determining appropriate design[1].

Design Criteria:

Appropriate on bank slopes of 3:1 or flatter for live construction section, 1.5:1 or flatter for boulder section.

Boulders must be keyed in (min. 3 feet) at the toe of bank.

Appropriate for local stream velocities of 6 feet per second or less.

Soil moisture conditions and availability of water year-around determines appropriate vegetation species (See plant palette).

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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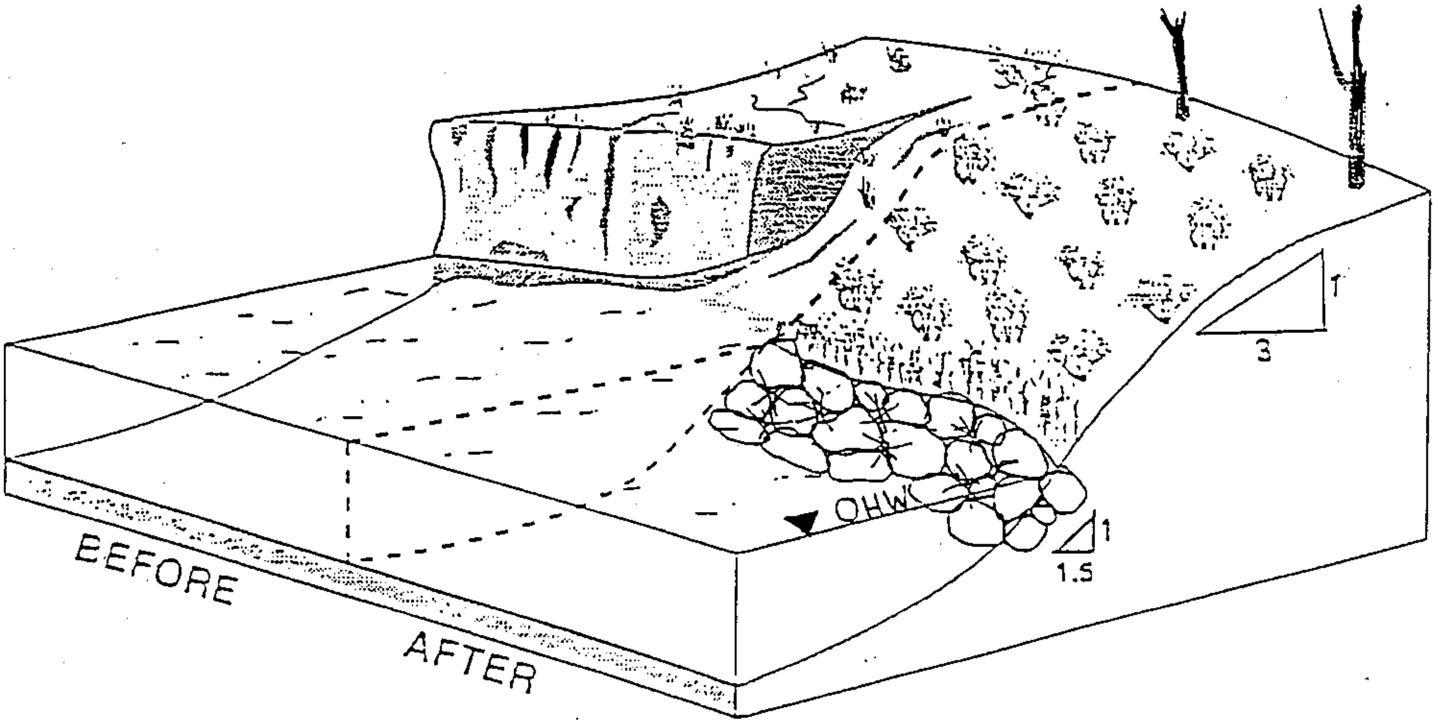
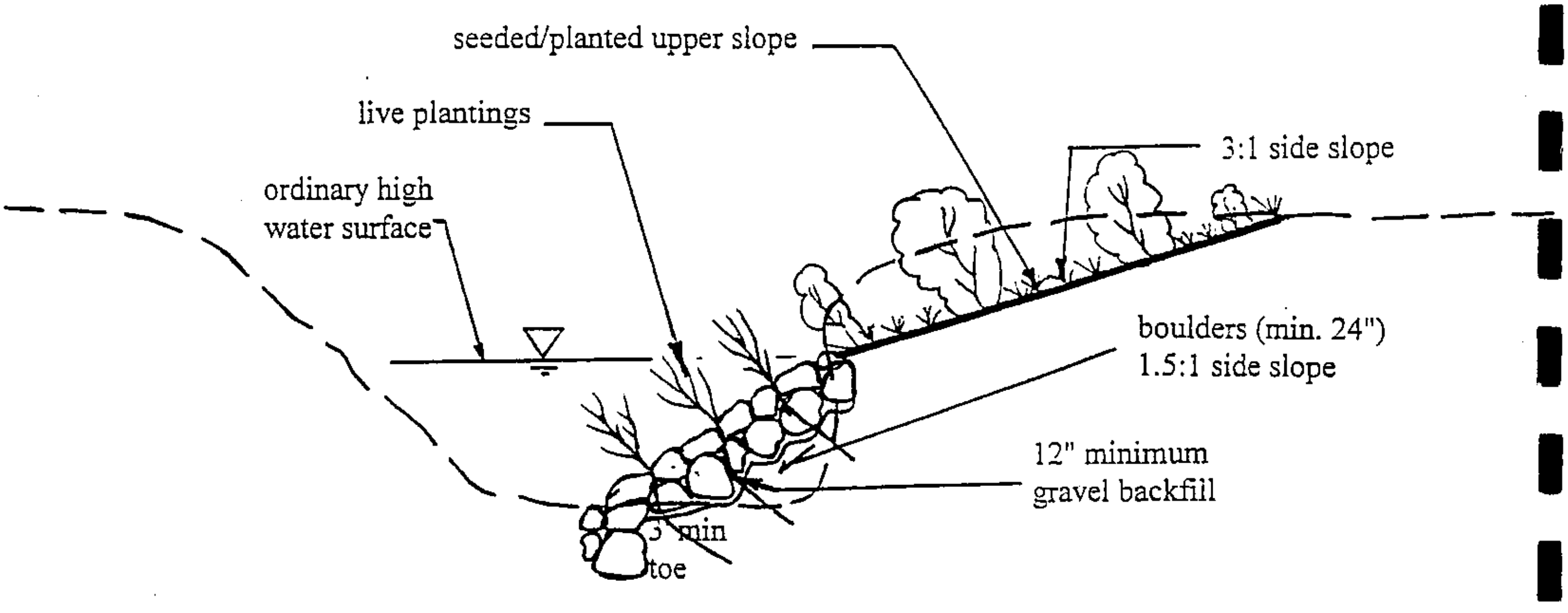
[1] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#2A: Live Construction with Boulder Toe Protection



Source: Adapted from Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices



Section View

Bank Protection Measures

#3: Contour Wattling

Description:

This method consists of tying long bundles of plant stems (typically willows or cottonwood) together with twine and anchoring them in shallow trenches with wooden stakes. When the stems develop root systems and mature, the plants establish structural soil stabilization properties. This technique is generally used to manage surface erosion.

Excellent revegetation potential. The long bundles trap and hold soil on banks by creating small, dam-like structures, effectively cutting the slope length into a series of shorter slope lengths. This method enhances the conditions for colonization by native species and should, where appropriate, be used with other soil bioengineering systems and live plantings. Reinforcement at the toe of bank may be a limiting factor (see BPM #3A). Not appropriate for treatment of slopes actively undergoing mass earth movement[1].

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter.

Appropriate for local stream velocities of 6 feet per second or less.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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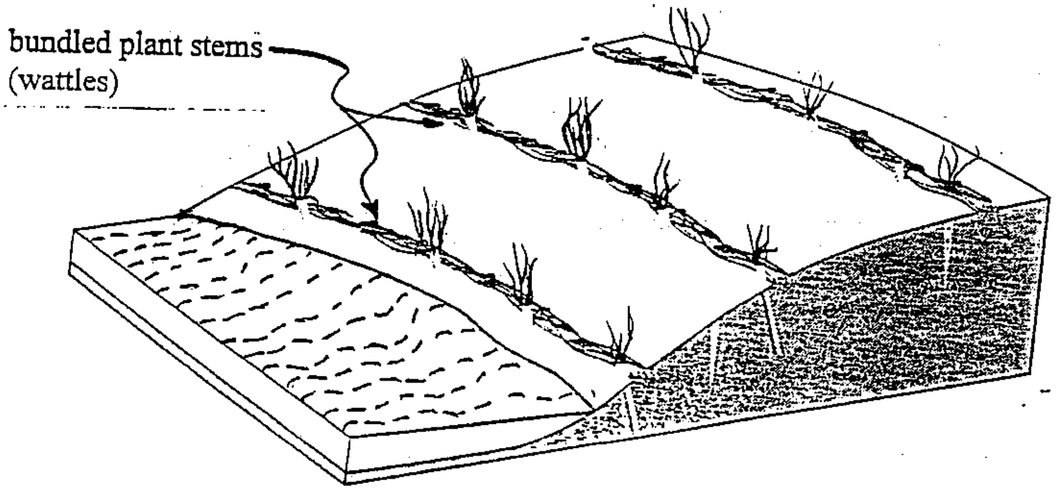
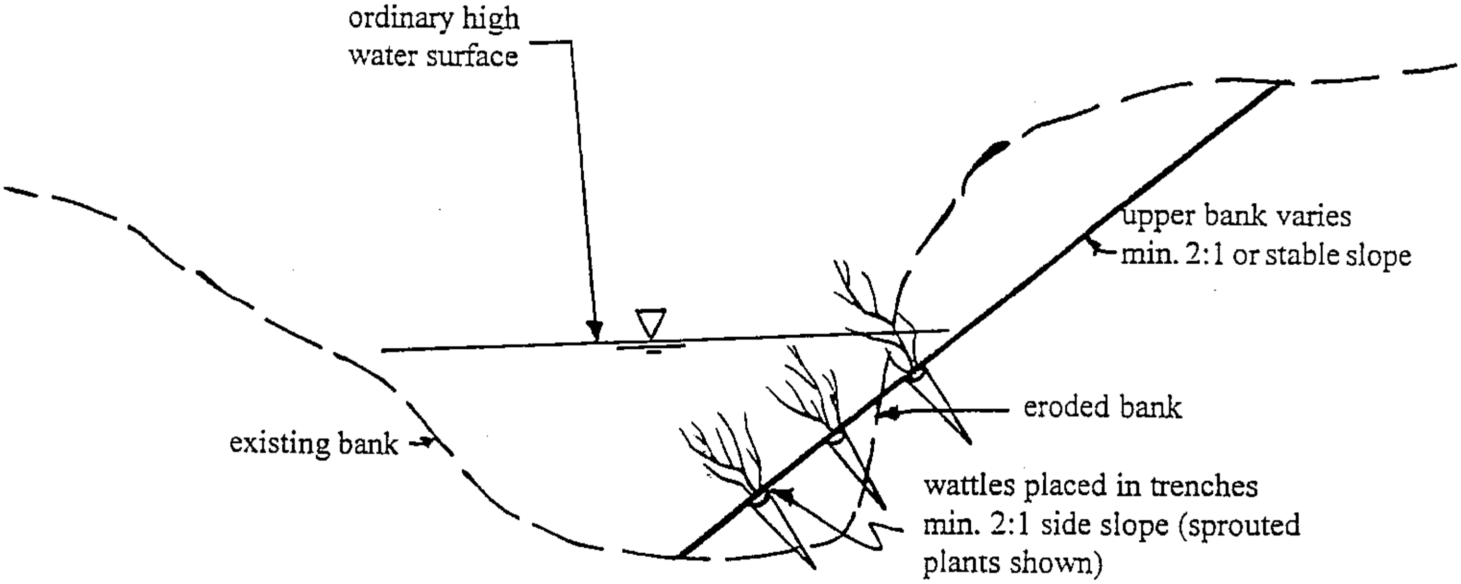
[1] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#3: Contour Wattling



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices



Section

Bank Protection Measures

#3A: Contour Wattling with Boulder Toe Protection

Description:

This method consists of tying long bundles of plant stems together with twine and anchoring them in shallow trenches with wooden stakes. When the stems develop root systems and mature, the plants establish structural soil stabilization properties.

Boulders (24" to 5 ton) are placed at the toe of the rebuilt bank up to the ordinary high water elevation. Voids in between the boulders can be planted using live stakes[1].

Excellent revegetation potential. The long bundles trap and hold soil on banks by creating small, dam-like structures, effectively cutting the slope length into a series of shorter slope lengths. This method enhances the conditions for colonization by native species and should, where appropriate, be used with other soil bioengineering systems and live plantings. Not appropriate for treatment of slopes actively undergoing mass earth movement[1].

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter for contour wattling section of slope, 1.5:1 or flatter for boulder section.

Boulders must be keyed in (min. 3 feet) at toe of bank.

Appropriate for local stream velocities of 6 feet per second or less.

Habitat Impact Assessment:

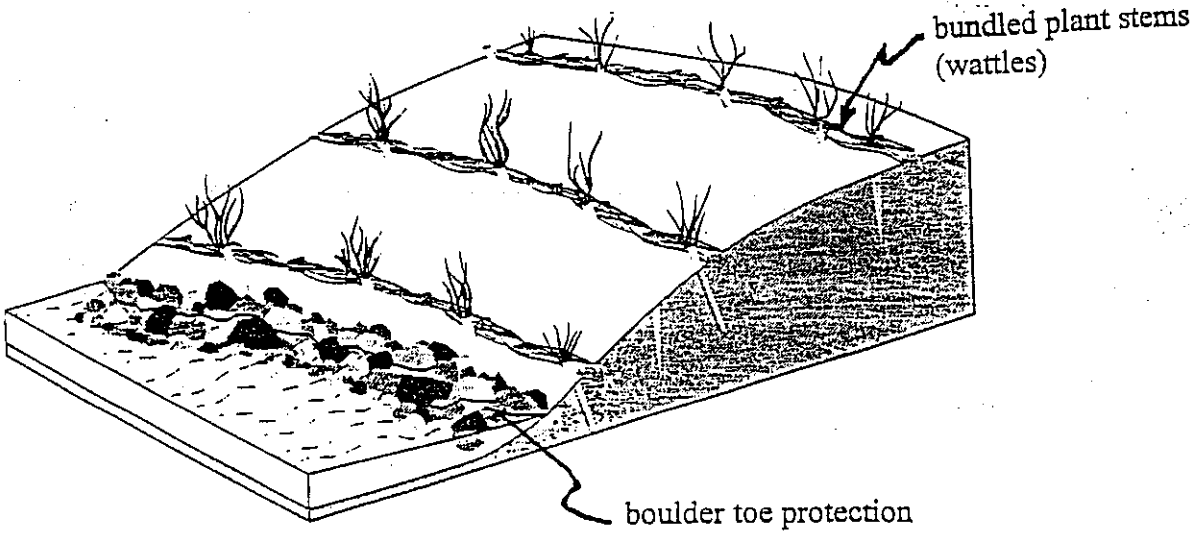
In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

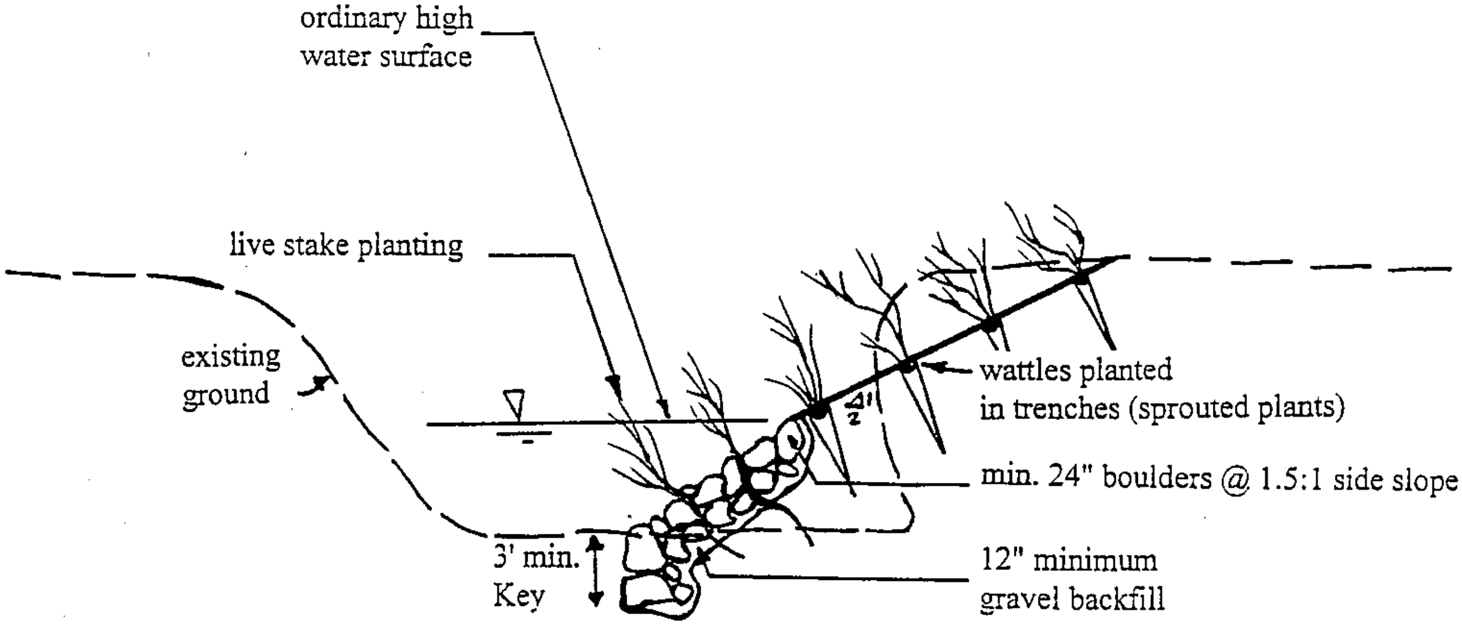
[1] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#3A: Contour Wattling with Boulder Toe Protection



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices



Section

Bank Protection Measures

#4: Brush Mattress (Brush Layering)

Description:

The eroded slope is graded and smoothed to ensure all willows are in contact with soil. A (min.) 2 foot deep trench is dug at the toe of the bank for the butt ends of the willow branches. Wood, steel, or live willow stakes are partially driven in rows on three foot centers in the area that will be covered by the mattress. After the stakes have been placed, live willow branches are put on the bank with their butt ends in the trench. Straight branches no shorter than 4 feet in length and ½" to 1" in diameter are used. If the branches are not long enough to reach the upper end of mattress, several layers may be used; however, it is necessary to "shingle" the layers by lapping each new layer over the one below by at least 18". Once the bank is covered by a thick layer of willows, cross branches are placed horizontally over the bottom layer. These branches are placed against the stakes and then tied to the stakes using wire or string. The stakes are then driven into the bank a minimum of two feet or deeper, if possible. After the completion of the mattress, the toe trench is filled with appropriately sized boulders and rocks to anchor the butt ends of the branches. The entire mattress is then covered by earth or fine stream material[1].

This method forms an immediate protective cover over the stream bank, captures sediment during flood flows, and rapidly restores riparian vegetation and streamside habitat. This measure is not appropriate where toe scour is anticipated (see BPM #4A). This method should not be used on slopes that are experiencing ongoing mass movement or other slope instability[2].

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter.

Appropriate for local stream velocities of 6 feet per second or less.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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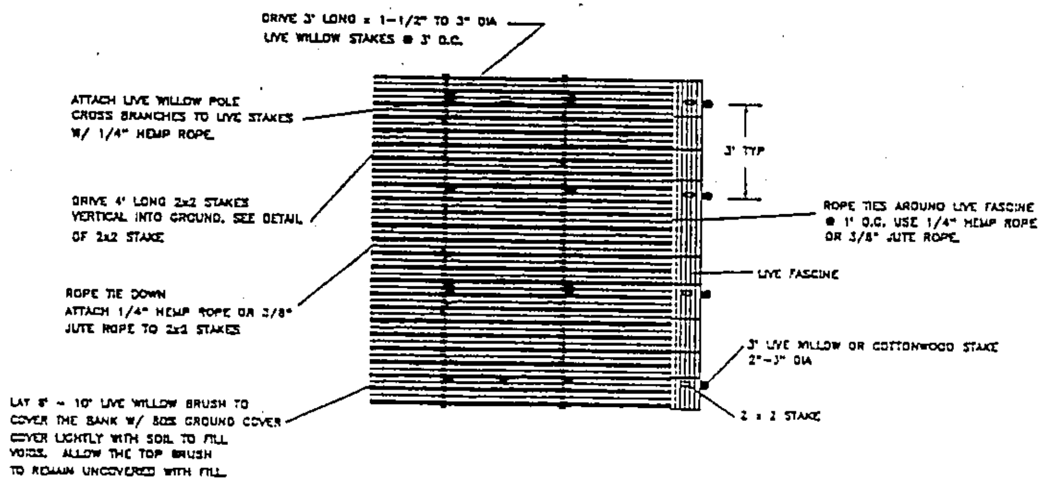
[1] Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

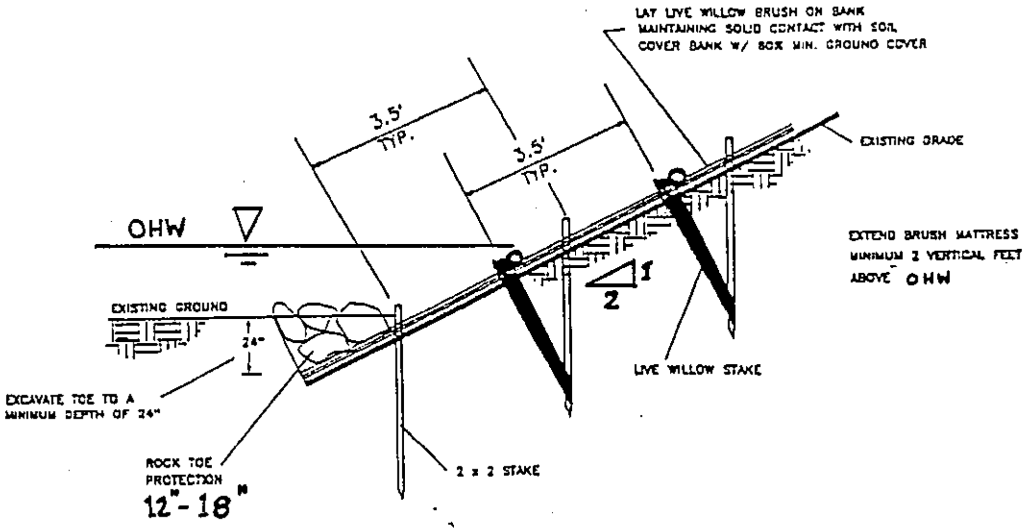
[2] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#4: Soil Bioengineering : Brush Mattress (Brush Layering)


DRIVE 3' LONG x 1-1/2" TO 3" DIA
LIVE WILLOW STAKES @ 3' O.C.
ATTACH LIVE WILLOW POLE CROSS BRANCHES TO LIVE STAKES W/ 1/4" HEMP ROPE.
DRIVE 4' LONG 2x2 STAKES VERTICAL INTO GROUND. SEE DETAIL OF 2x2 STAKE
ROPE TIE DOWN
ATTACH 1/4" HEMP ROPE OR 3/8" JUTE ROPE TO 2x2 STAKES
LAY 8' ~ 10' LIVE WILLOW BRUSH TO COVER THE BANK W/ 80% GROUND COVER COVER LIGHTLY WITH SOIL TO FILL VOIDS. ALLOW THE TOP BRUSH TO REMAIN UNCOVERED WITH FILL
3' TYP
ROPE TIES AROUND LIVE FASCINE @ 1' O.C. USE 1/4" HEMP ROPE OR 3/8" JUTE ROPE.
LIVE FASCINE
3' LIVE WILLOW OR COTTONWOOD STAKE 2"-3" DIA
2 x 2 STAKE

Plan View


LAY LIVE WILLOW BRUSH ON BANK MAINTAINING SOLID CONTACT WITH SOIL COVER BANK W/ 80% MIN. GROUND COVER
3.5' TYP.
3.5' TYP.
EXISTING GRADE
OHW
EXTEND BRUSH MATTRESS MINIMUM 2 VERTICAL FEET ABOVE OHW
1
2
EXISTING GROUND
24"
LIVE WILLOW STAKE
EXCAVATE TOE TO A MINIMUM DEPTH OF 24"
ROCK TOE PROTECTION
12"-18"
2 x 2 STAKE

Cross Section

Source: Adapted from California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#4A: Brush Mattress (Brush Layering) with Boulder Toe Protection

Description:

The lower portion of the eroded slope (Below Ordinary High Water OHW) is graded (at a maximum of 1.5:1 slope). The upper portion of the slope is graded (at a minimum slope of 2:1) and smoothed to ensure all willows are in contact with soil. Boulders (24" to 5 ton) are placed at the toe of the rebuilt bank up to the ordinary high water elevation. Voids between the boulders can be planted using live stakes[2].

A (min.) 2 foot deep trench is dug at the top of the boulder line for the butt ends of the willow branches. Wood, steel, or live willow stakes are partially driven in rows on three foot centers in the area that will be covered by the mattress. After the stakes have been placed, live willow branches are put on the bank with their butt ends in the trench. Straight branches no shorter than 4 feet in length and ½" to 1" in diameter are used. If the branches are not long enough to reach the upper end of mattress, several layers may be used; however, it is necessary to "shingle" the layers by lapping each new layer over the one below by at least 18". Once the bank is covered by a thick layer of willows, cross branches are placed horizontally over the bottom layer. These branches are placed against the stakes and then tied to the stakes using wire or string. The stakes are then driven into the bank a minimum of two feet or deeper, if possible. After the completion of the mattress, the toe trench is back-filled with boulders and rocks to anchor the butt ends of the branches. The entire mattress is then covered by earth or fine stream material[1].

This method forms an immediate protective cover over the stream bank, captures sediment during flood flows, and rapidly restores riparian vegetation and streamside habitat. This method should not be used on slopes that are experiencing ongoing mass movement or other slope instability[2].

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter for brush mattress section of slope, 1.5:1 or flatter for the boulder section.

Boulders must be keyed in (min. 3 feet) at toe of bank.

Appropriate for local stream velocities of 6 feet per second or less.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

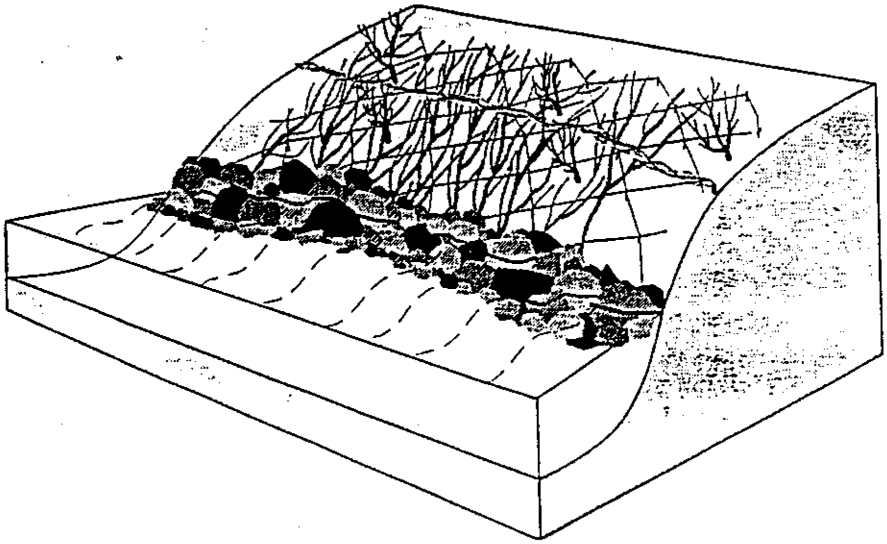
See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

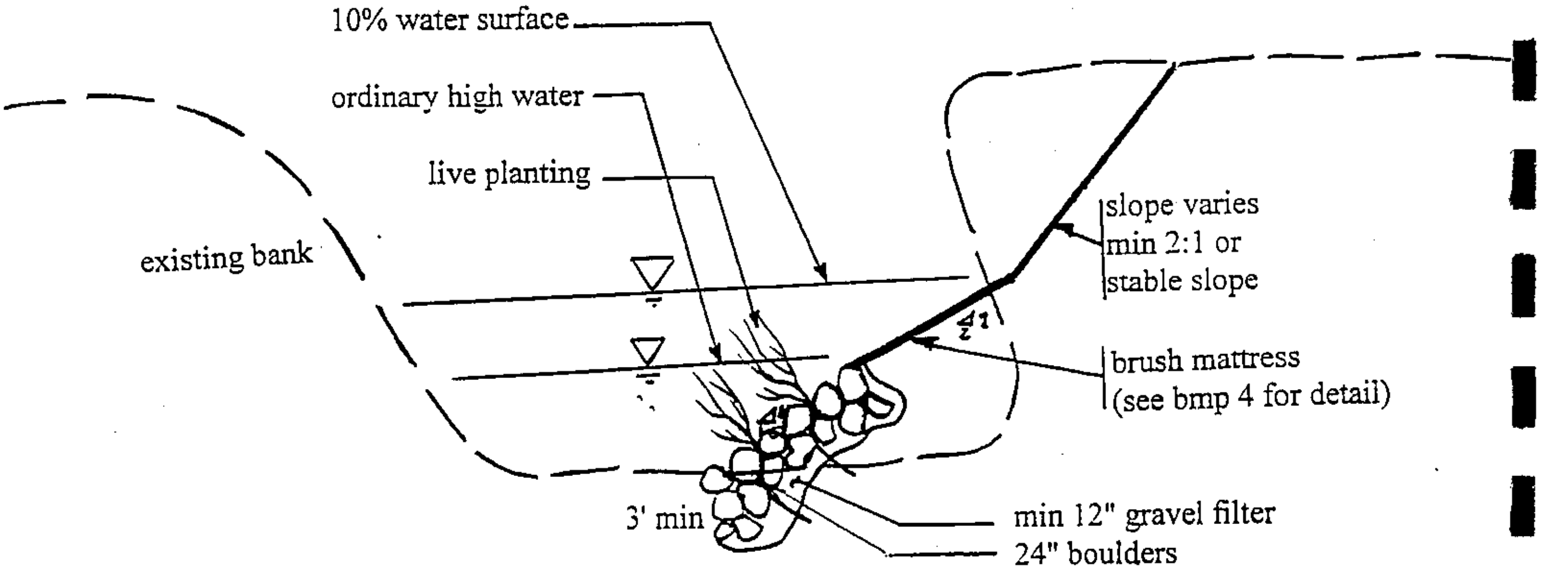
[2] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices

Bank Protection Measures

#4A: Brush Mattress (Brush Layering) with Boulder Toe Protection



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices



Section

Bank Protection Measures

#5: Surface Matting (Erosion Mats)

Description:

This method consists of securing plastic, jute, or geotextile fabric surface liners to channel banks using stakes or staples. These materials provide soft armor protection against erosive forces and are combined with live staking and direct seeding. Abrasive sediment, debris, foot traffic, and sunlight will wear, snag, and tear these fabrics with time, potentially undermining the structure. These methods are intended to be the skeleton of a vegetated erosion control system. The establishment of vegetation is crucial to the long-term success of erosion mats.

Work best in small, uniform, improved channels with mild bank slopes. This method has good revegetation potential. Toe protection is required where toe scour is anticipated (see BPM #5A).

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter.

Typically appropriate for local stream velocities of 12 feet per second or less, depending on the type of erosion mat and revegetation method selected.

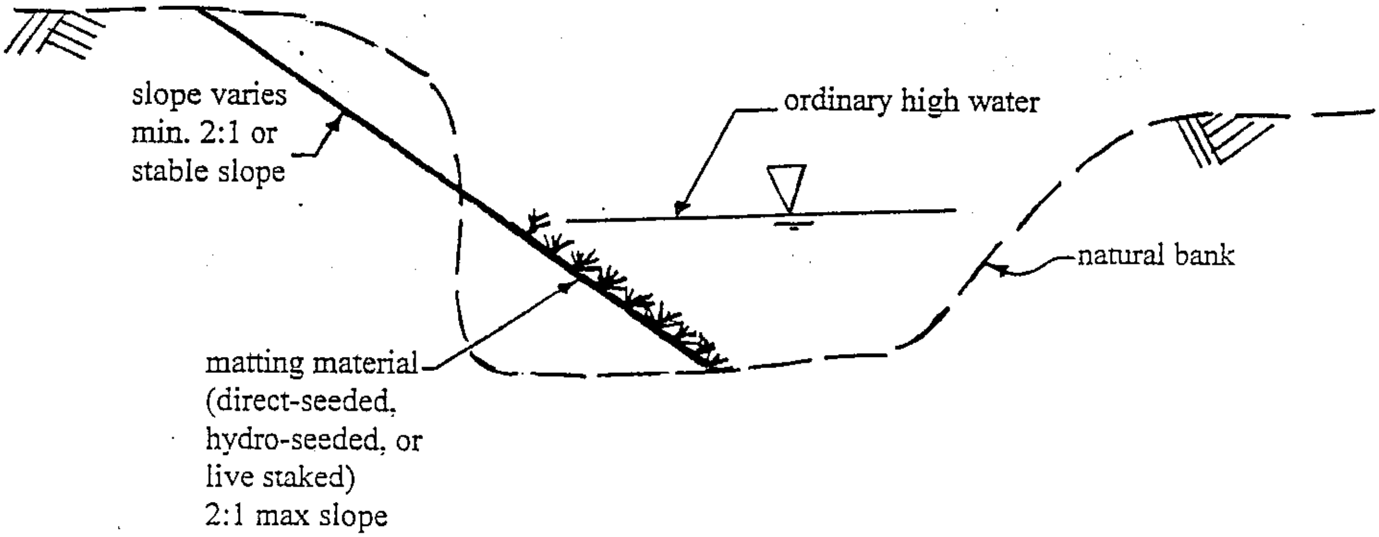
Habitat Impact Assessment:

In-stream:	Provide limited biotic resources
Stream-side:	Provide limited biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#5: Surface Matting (Erosion Mats)



Section

Bank Protection Measures

#5A: Surface Matting (Erosion Mats) with Boulder Toe Protection

Description:

The lower portion of the eroded slope (Below Ordinary High Water OHW) is graded (at a maximum of 1.5:1 slope). The upper portion of the slope is graded (at a minimum slope of 2:1) and smoothed to ensure erosion mat is in full contact with soil. Boulders (24" to 5 ton) are placed at the toe of the rebuilt bank up to the ordinary high water elevation. Voids between the boulders can be planted using live stakes

In the upper portion of the slope, plastic, jute, or geotextile fabric surface liners are attached to channel banks using stakes or staples. These materials provide soft armor protection against erosive forces and are combined with live staking and direct seeding. Debris, foot traffic, and sunlight will wear, snag, and tear these fabrics with time. The boulder toe protection will prevent undermining of the structure. These methods are intended to be the skeleton of a vegetated erosion control system.

Work best in uniform improved channels with mild bank slopes. This method has good revegetation potential.

Design Criteria:

Appropriate on bank slopes of 2:1 or flatter for erosion mat section of slope, 1.5:1 or flatter for the boulder section.

Boulders must be keyed in (min. 3 feet) at toe of bank.

Appropriate for local stream velocities of 6 feet per second or less if boulders are planted with live stakes, 12 feet per second if boulders are not planted.

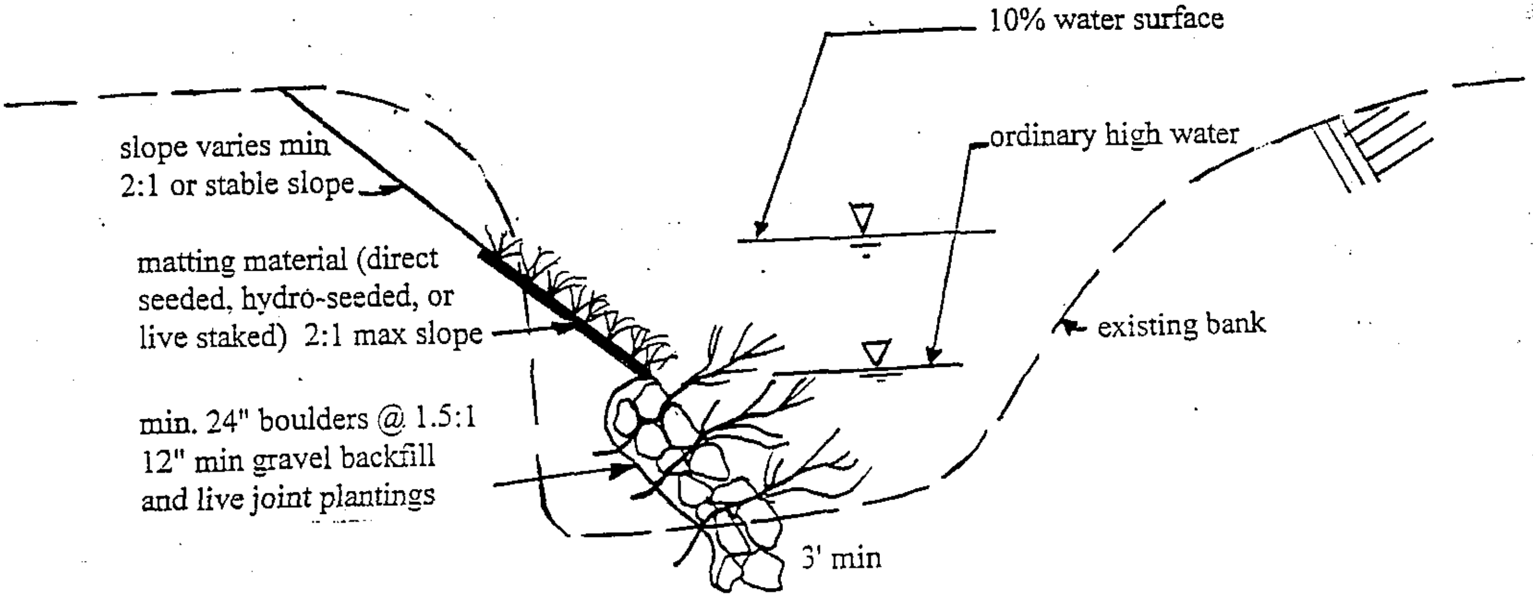
Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#5A: Surface Matting (Erosion Mats) with Boulder Toe Protection



Section

Bank Protection Measures

#6: Root Wads and Boulders

Description:

This method combines boulders, logs, and live plant material to armor a stream bank. Fish habitat is enhanced, in addition to creating a natural looking bank stabilization structure[1].

Footer logs are set in a toe trench below the thalweg line, with the channel end pointed downstream and the butt end angled 45 to 60 degrees upstream. A second log (with a root wad) is set on top of the footer log diagonally, forming an "X". The root wad end is set pointing upstream and the butt end lying downstream 45 to 60 degrees. The apex of the logs are anchored together using boulders, re-bar or cables. Large boulders are placed on top and between the logs at each apex. After all the logs and boulders are set in place, live plant material such as willows are placed within the spaces of the structure, behind the boulders. Excavated gravel and stream materials can then be placed over the bank end portion of the structure[1].

This method will tolerate high boundary shear stresses if logs and root wads are well anchored. This method should, where appropriate, be used in conjunction with soil bio-engineering or live vegetation plantings to stabilize the upper bank and ensure a regenerative source of streambank vegetation. The life of the structure depends on the species of logs used, it might need replacement if vegetative colonization does not take place. This method can create local scour (channel bottom) and erosion (opposite bank)[2].

Design Criteria:

Appropriate for channel velocities of 10 feet per second or less.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

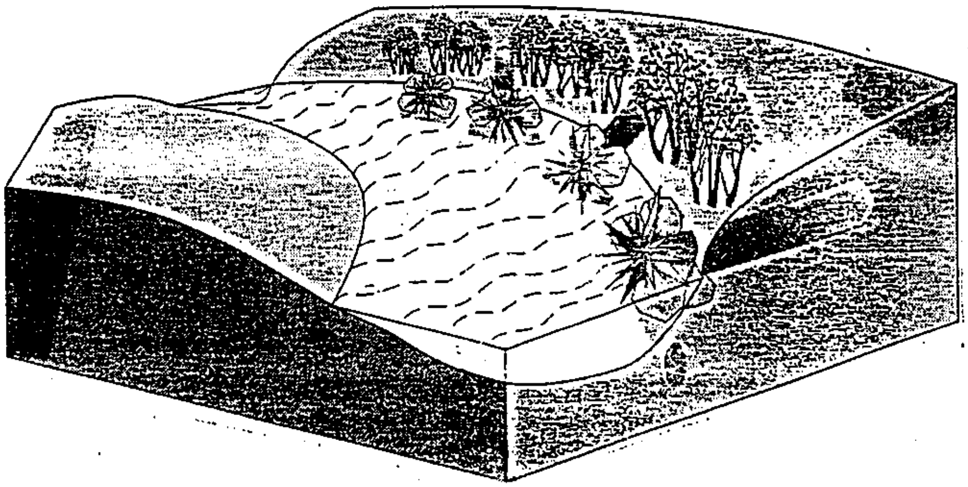
---

[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

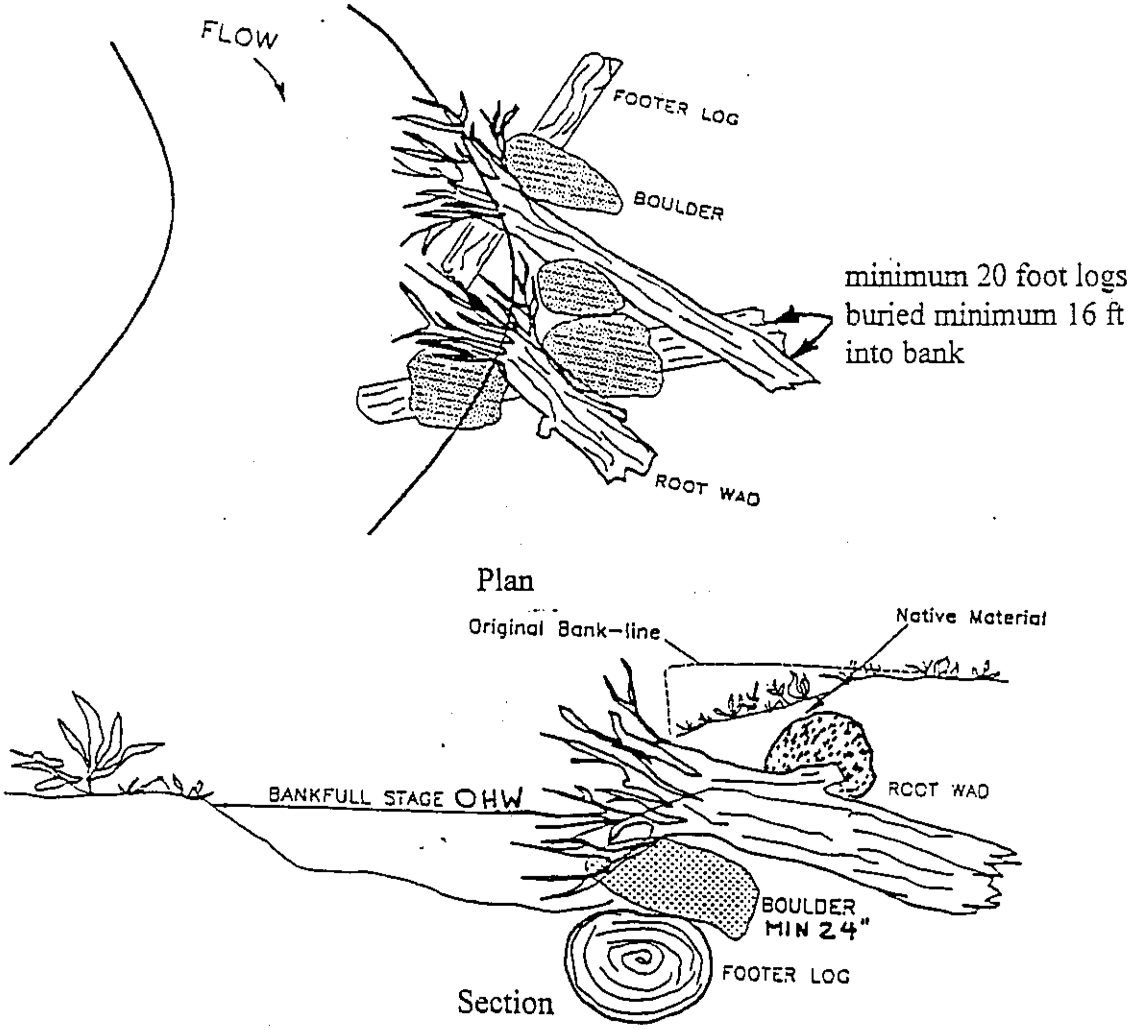
[2] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices

Bank Protection Measures

#6: Root Wads and Boulders



Source: Adapted from Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices.



minimum 20 foot logs
buried minimum 16 ft
into bank

Plan

Section

Source: Adapted from California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#7: Cellular Confinement System

Description:

Soil cellular confinement system (geocell) is a polyethylene plastic cellular system where structural strength is developed by the composite design of soil, plant roots, and the plastic's cellular configuration. This system is available in 8-inch deep honeycomb mats that are installed in offset vertical layers to create terraced planting areas. The honeycomb cells are filled with soil, moderately compacted, and planted with woody vegetation and grasses. The structure functions similarly to a crib wall structure.

This method has the capability of developing some vegetation potential.

Design Criteria:

Appropriate for slopes up to ½ to 1.

Appropriate for velocities up to 6 feet per second.

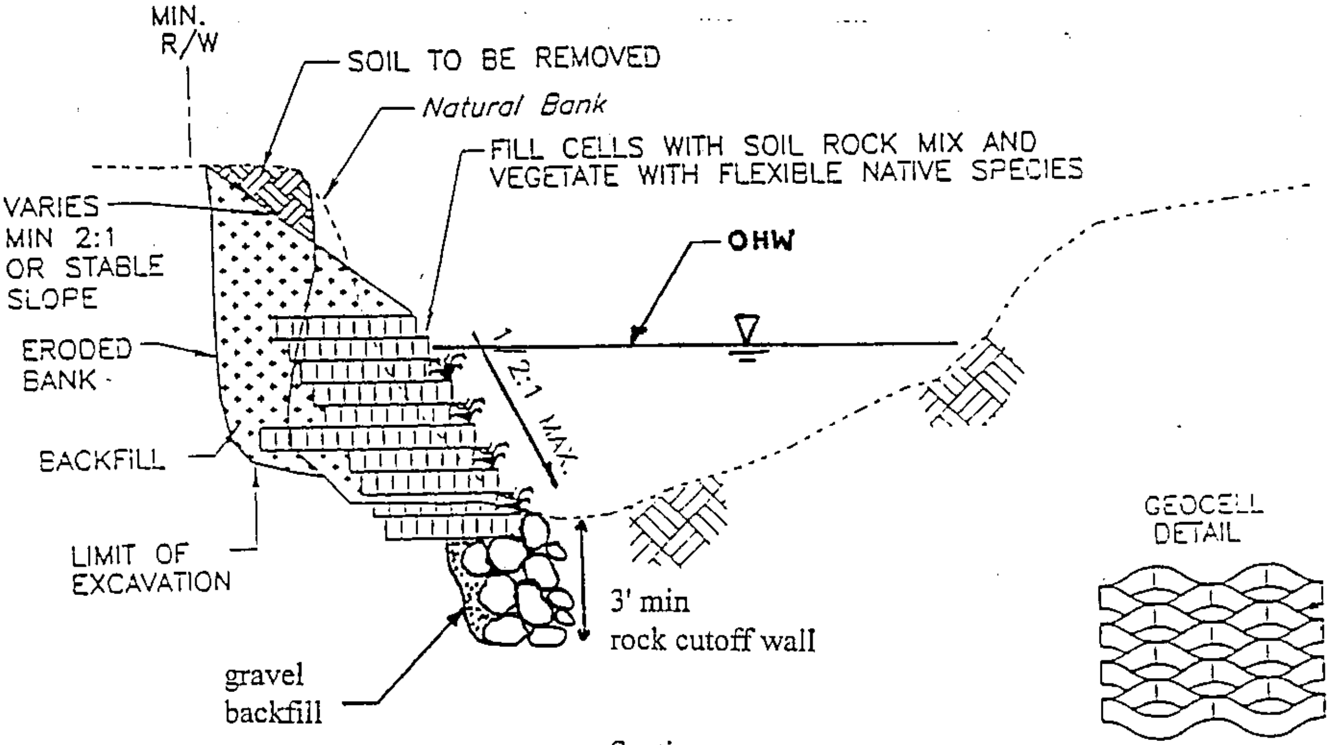
Habitat Impact Assessment:

In-stream:	Reduce or eliminate biotic potential
Stream-side:	Reduce or eliminate biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#7: Cellular Confinement System



Section

Bank Protection Measures

#7A: Cellular Confinement System with Vortex Weirs

Description:

Soil cellular confinement system (geocell) is a polyethylene plastic cellular system where structural strength is developed by the composite design of soil, plant roots, and the plastic's cellular configuration. This system is available in 8-inch deep honeycomb mats that are installed in offset vertical layers to create terraced planting areas. The honeycomb cells are filled with soil, moderately compacted, and planted with woody vegetation and grasses. The structure functions similarly to a crib wall structure. This method has the capability of developing some ruderal vegetation potential.

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1].

The vortex weirs are placed on the downstream end of the erosion repair project to stabilize the creek profile and protect the foundation of the erosion repair project.

Design Criteria:

Appropriate for slopes up to ½ to 1.

Appropriate for velocities up to 6 feet per second.

Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Reduces or eliminates biotic potential

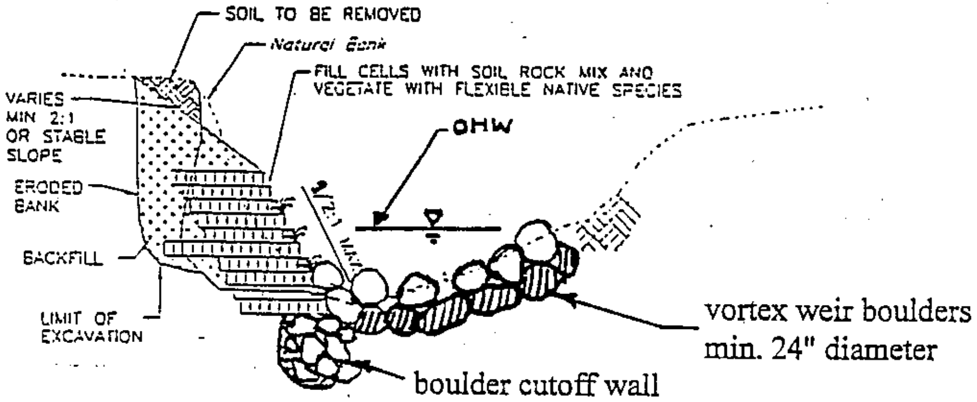
See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

---

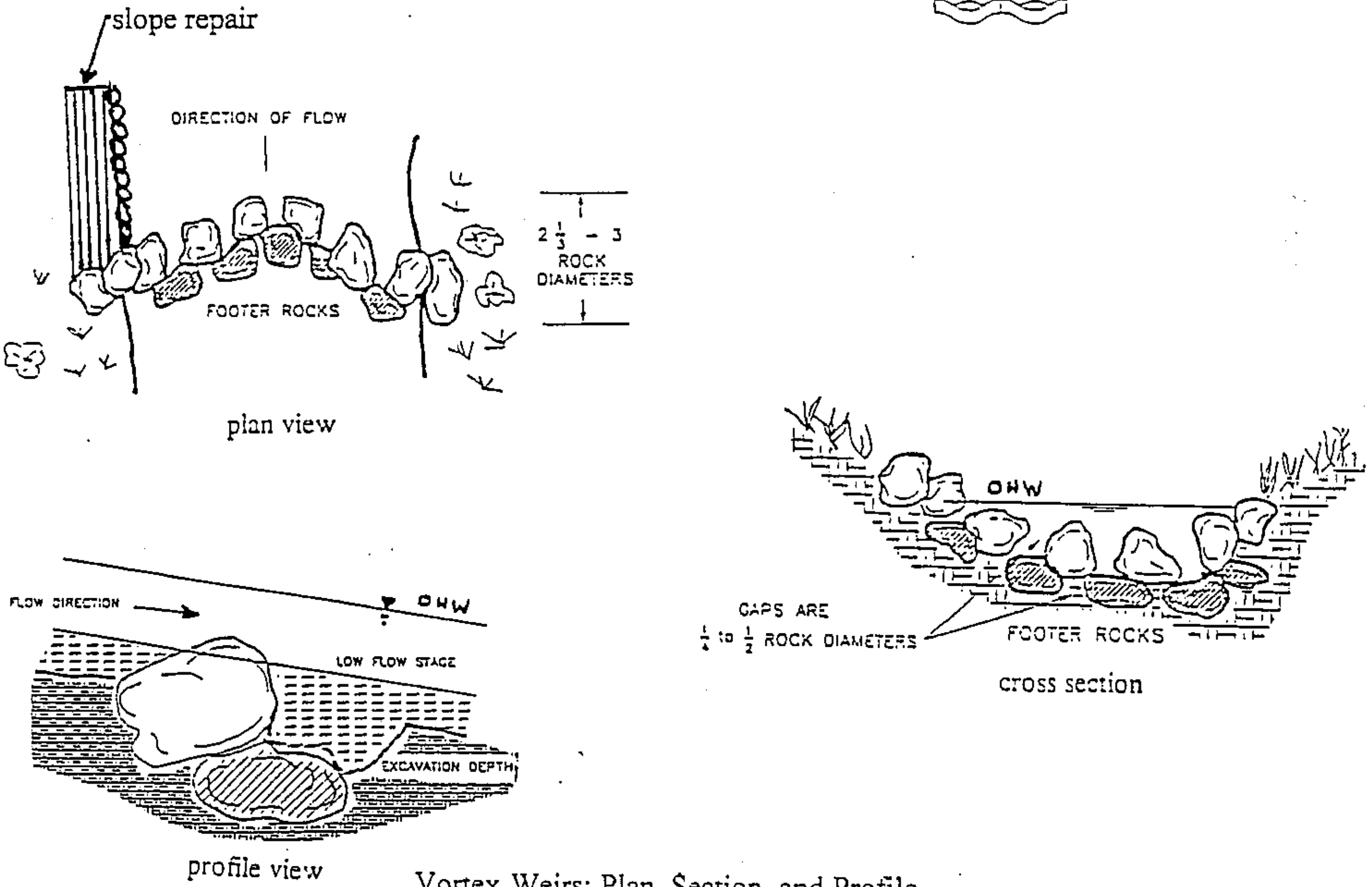
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#7A: Cellular Confinement System with Vortex Weirs


SOIL TO BE REMOVED
Natural Bank
FILL CELLS WITH SOIL ROCK MIX AND VEGETATE WITH FLEXIBLE NATIVE SPECIES
VARIES MIN 2:1 OR STABLE SLOPE
OHW
ERODED BANK
BACKFILL
LIMIT OF EXCAVATION
1/2:1 MAX
vortex weir boulders min. 24" diameter
boulder cutoff wall

Section



plan view

profile view

cross section

Vortex Weirs: Plan, Section, and Profile

Source: Adapted from California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#8: Rock Blanket

Description:

This method consists of placing a blanket of appropriately sized rock over the bank to control erosion. The rock is underlain by at least 12 inches of gravel to eliminate washout of underlying soils, which would lead to slope failure in time. This method is appropriate where long term durability is needed, design discharge is high, there is significant threat to life or property, or there is no practical way to otherwise incorporate vegetation into the design. This method should, where appropriate, be used with soil bio-engineering systems or live vegetation to stabilize the upper bank and ensure a regenerative source of streambank vegetation. A major benefit of this method is that the components are flexible and function is not impaired by slight movement from settlement or other adjustments[1].

Angular rock should be used, because they tend to interlock, making the structure act like a single structure rather than a collection of independent stones.

Design Criteria:

Appropriate for slopes up to 1.5 to 1, preferably 2 to 1.

Rock sizes of 6" to 18" (Dia).

Appropriate for velocities up to 15 feet per second.

Habitat Impact Assessment:

In-stream:	Reduce or eliminate biotic potential
Stream-side:	Reduce or eliminate biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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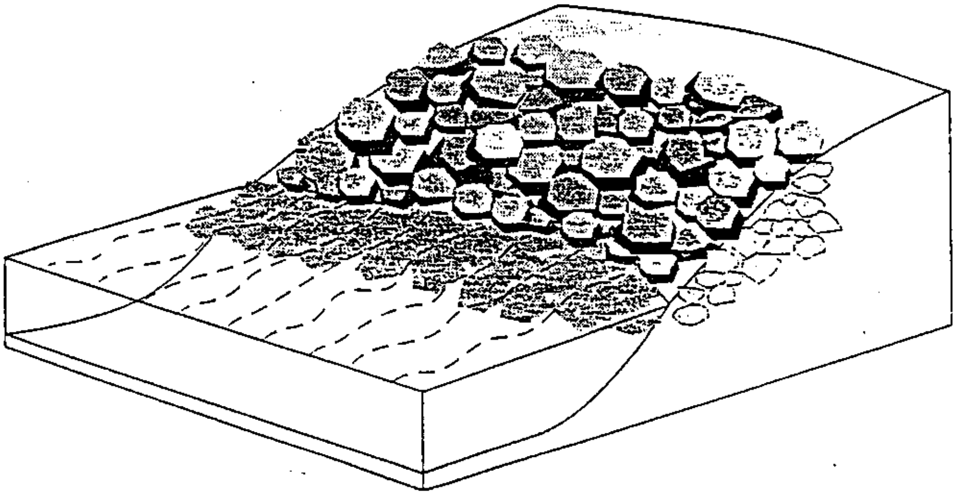
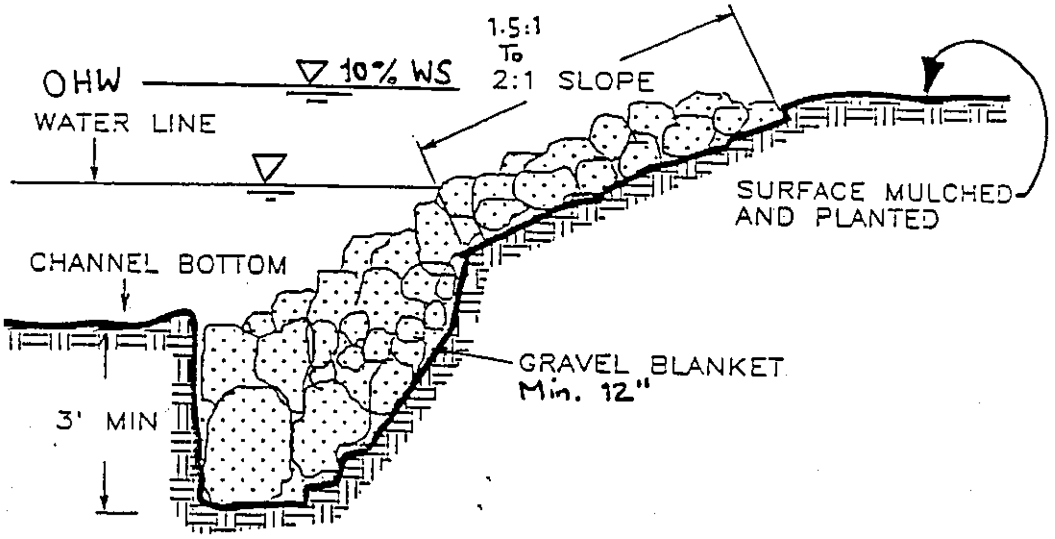
[1] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#8: Rock Blanket



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices



Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#8A: Boulder Revetment

Description:

Boulder rip-rap is a method for armoring stream banks with large boulders for preventing bank erosion. Rip-rap footing is laid in a "toe" trench dug along the base of the bank. Large boulders (min. 24") are then laid on the bank slopes up to the design water surface level (ordinary high water or other design water surface). Large angular boulders are best suited for this purpose. Boulder rip-rap can provide protection in areas where log or boulder instream structures may lead to bank erosion. The boulders used should be dense and structurally competent[1].

A gravel blanket that is at least 1 foot thick should be placed under the boulder rip-rap on slopes of 1:1 or greater. This is to prevent underlying soil from being washed out and causing slope slump and possible failure during periods of high flow. Geotextile fabrics should be avoided, as they prevent the natural establishment of vegetation[1].

This method should, where appropriate, be used with soil bio-engineering systems or live vegetation to stabilize the upper bank and ensure a regenerative source of streambank vegetation. A major benefit of this method is that the components are flexible and function is not impaired by slight movement from settlement or other adjustments[2].

This structure would allow for some natural revegetation of the bank.

Design Criteria:

Appropriate for slopes up to 1 to 1, preferably 2 to 1.

Appropriate for velocities up to 6 feet per second if boulder joints are planted, 15 feet per second if boulders are not planted.

Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Provides limited biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

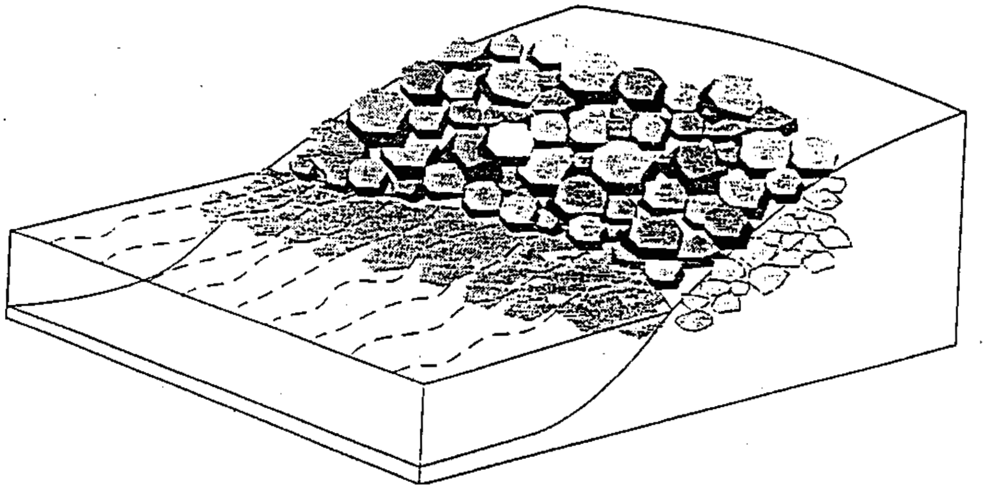
---

[1] Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

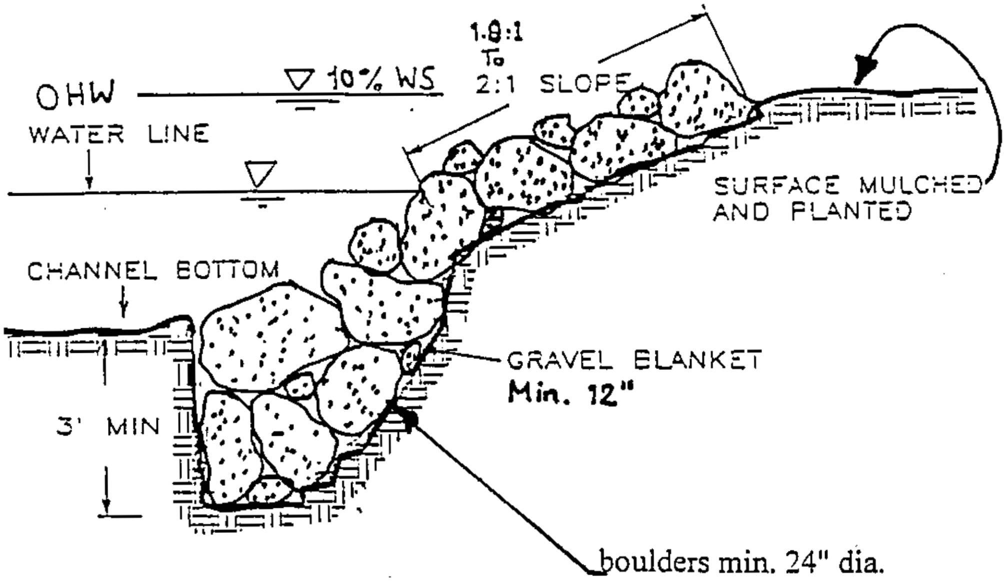
[2] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#8A: Boulder Revetment



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles, Processes and Practices



Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#8B: Boulder Revetment with Soil and Revegetation

Description:

Boulder rip-rap is a method for armoring stream banks with large boulders for preventing bank erosion. Rip-rap footing is laid in a "toe" trench dug along the base of the bank. Large boulders (min. 24") are then laid on the bank slopes up to the ordinary high water or other design water surface. Large angular boulders are best suited for this purpose. Boulder rip-rap can provide protection in areas where log or boulder instream structures may lead to bank erosion. The boulders used should be dense and structurally competent[1].

Soil is placed over the boulders and vegetation is installed by staking and/or direct seeding. Biodegradable erosion control mats are placed over the soil to help control erosion until vegetation establishes itself. Special care must be taken in staking to avoid damage to the stakes' cambium and to ensure good soil/water/stake contact. Thick rip-rap layers may require special tools for establishing staking pilot holes[2].

A gravel blanket that is at least 1 foot thick should be placed under the boulder rip-rap on slopes of 1:1 or greater. This is to prevent underlying soil from being washed out and causing slope slump and possible failure during periods of high flow. Geotextile fabrics should be avoided, as they prevent the natural establishment of vegetation[1].

This method should, where appropriate, be used with soil bio-engineering systems or live vegetation to stabilize the upper bank and ensure a regenerative source of streambank vegetation. A major benefit of this method is that the components are flexible and function is not impaired by slight movement from settlement or other adjustments[2].

Design Criteria:

Appropriate for slopes up to 1 to 1, preferably 2 to 1.
Appropriate for velocities up to 6 feet per second.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Provides limited biotic resources

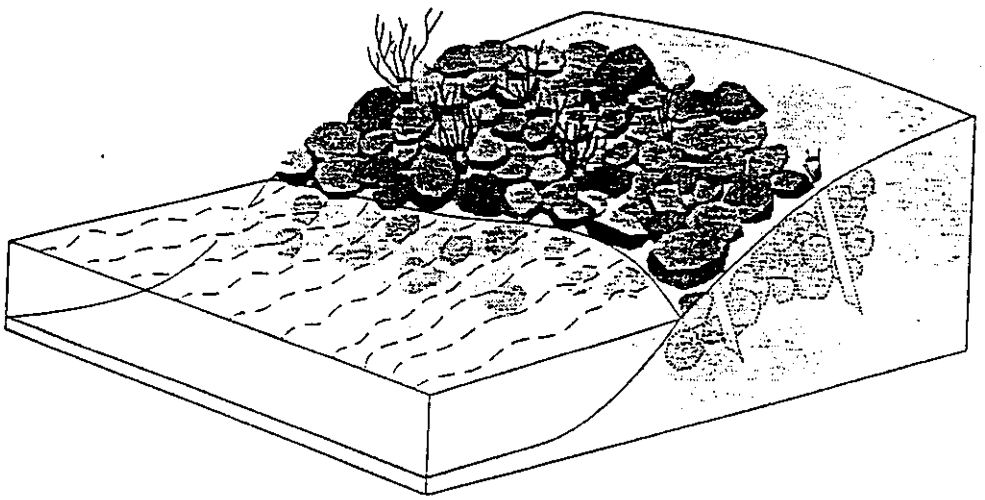
See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

[1] Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

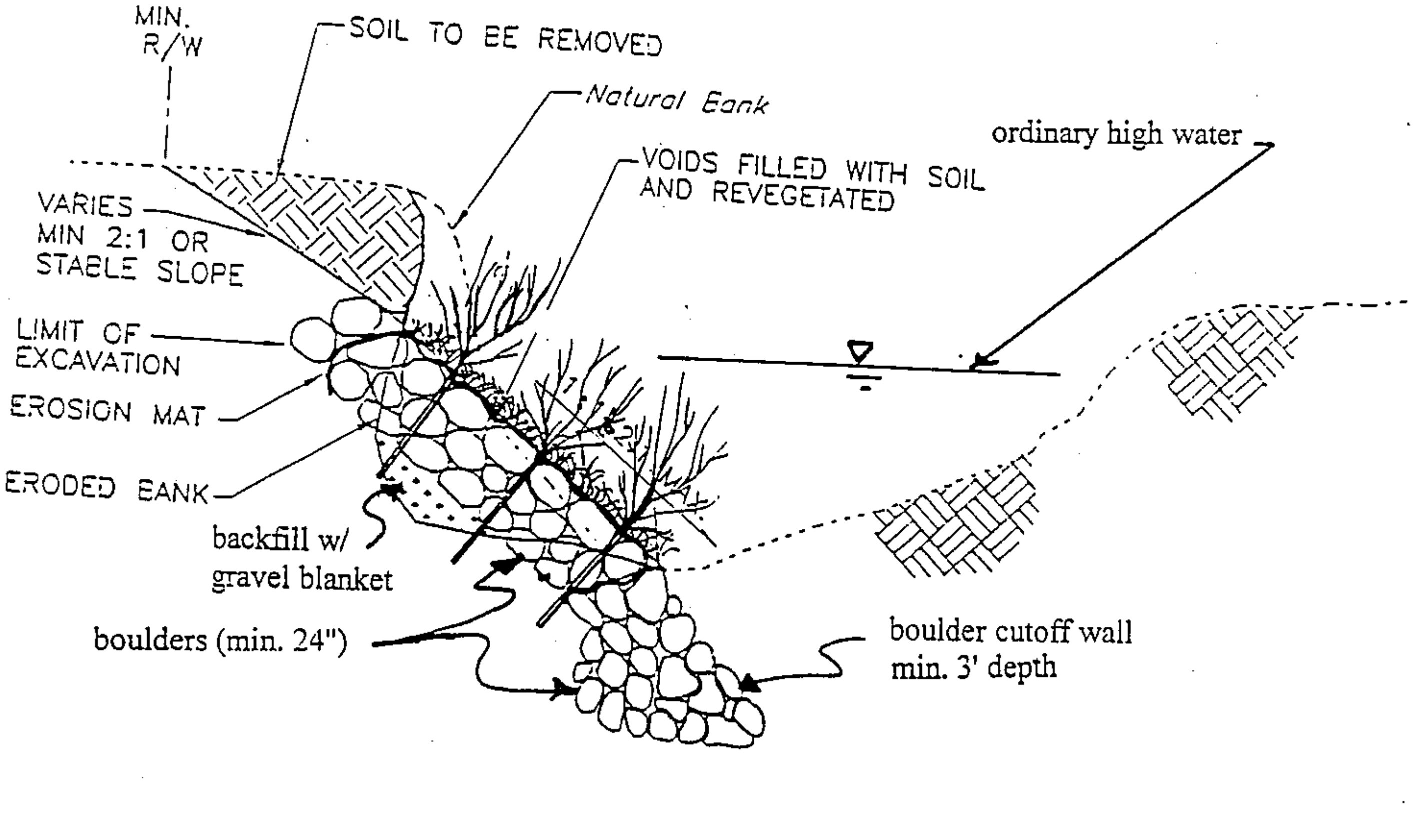
[2] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#8B: Boulder Revetment with Soil and Revegetation



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles, Processes and Practices


MIN. R/W
SOIL TO BE REMOVED
Natural Bank
VOIDS FILLED WITH SOIL AND REVEGETATED
ordinary high water
VARIES MIN 2:1 OR STABLE SLOPE
LIMIT OF EXCAVATION
EROSION MAT
ERODED BANK
backfill w/ gravel blanket
boulders (min. 24")
boulder cutoff wall min. 3' depth

Section

Bank Protection Measures

#8C: Boulder Revetment with Soil and Revegetation, and Vortex Weir

Description:

Boulder rip-rap is a method for armoring stream banks with large boulders for preventing bank erosion. Rip-rap footing is laid in a "toe" trench dug along the base of the bank. Large boulders (min. 24") are then laid on the bank slopes up to the design water surface level (ordinary high water or other design water surface). Large angular boulders are best suited for this purpose. Boulder rip-rap can provide protection in areas where log or boulder instream structures may lead to bank erosion. The boulders used should be dense and structurally competent[1].

Soil is placed over the boulders and vegetation is installed by staking and/or direct seeding. Biodegradable erosion control mats are placed over the soil to help control erosion until vegetation establishes itself. Special care must be taken in staking to avoid damage to the stakes' cambium and to ensure good soil/water/stake contact. Thick rip-rap layers may require special tools for establishing staking pilot holes[2].

A gravel blanket that is at least 1 foot thick should be placed under the boulder rip-rap on slopes of 1:1 or greater. This is to prevent underlying soil from being washed out and causing slope slump and possible failure during periods of high flow. Geotextile fabrics should be avoided, as they prevent the natural establishment of vegetation[1].

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1]. Weirs should be placed on downstream side of bank repair to protect profile.

This method should, where appropriate, be used with soil bio-engineering systems or live vegetation to stabilize the upper bank and ensure a regenerative source of streambank vegetation. A major benefit of this method is that the components are flexible and function is not impaired by slight movement from settlement or other adjustments[2].

Design Criteria:
Appropriate for slopes up to 1 to 1, preferably 2 to 1.
Appropriate for velocities up to 6 feet per second.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Provides limited biotic resources

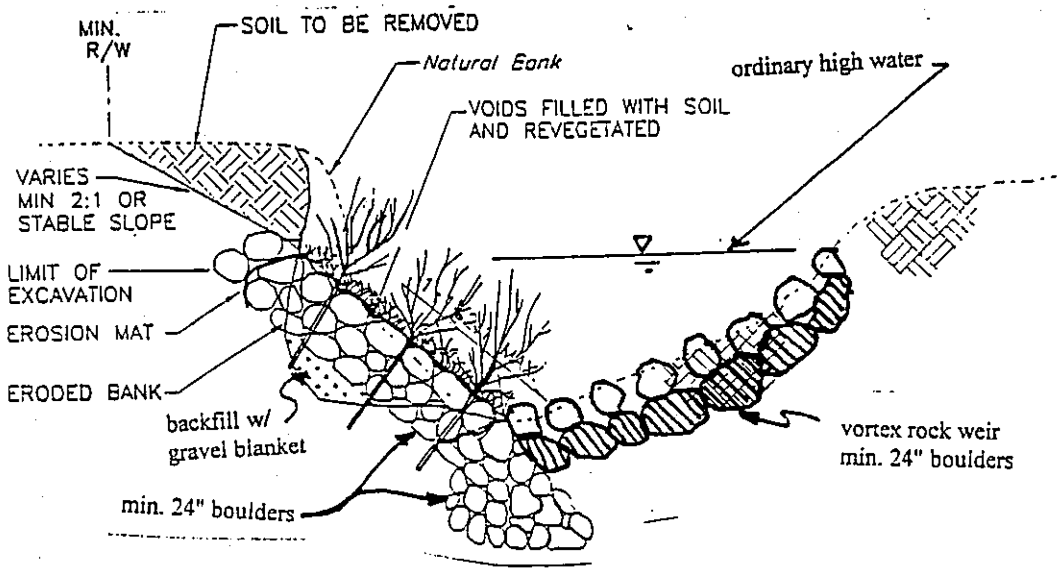
See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

---

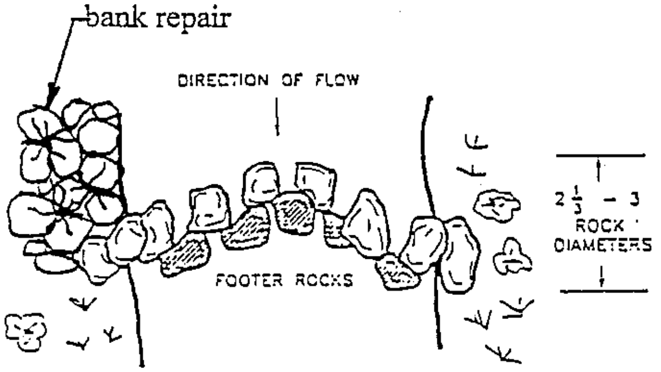
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual
[2] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices

Bank Protection Measures

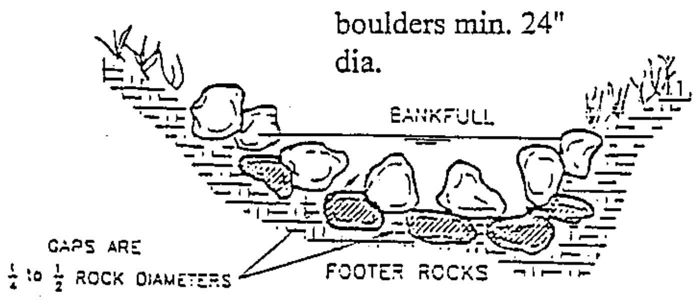
#8C: Boulder Rip-Rap, with Soil and Revegetation, and Vortex Weir


MIN. R/W
SOIL TO BE REMOVED
Natural Bank
ordinary high water
VOIDS FILLED WITH SOIL AND REVEGETATED
VARIES MIN 2:1 OR STABLE SLOPE
LIMIT OF EXCAVATION
EROSION MAT
ERODED BANK
backfill w/ gravel blanket
min. 24" boulders
vortex rock weir min. 24" boulders

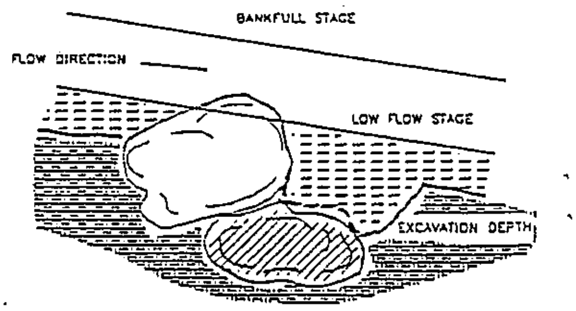
Section



plan view



cross section



profile view

Vortex Weirs: Plan, Section, and Profile

Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#9: Stepped Gabions

Description:

This method consists of large wire baskets filled with rocks and placed on channel banks as mattresses or stacked in layers that resemble steps. The slope protection is extended until the ordinary high water surface level is reached. A rock cutoff wall is required if channel invert protection is not provided to prevent undermining the structure. Gabions can sometimes naturally revegetate, if adequate water and soil are available.

Design Criteria:

Appropriate for bank slopes from 0.75 to1 up to 3 to 1.

Appropriate for velocities up to 15 feet per second.

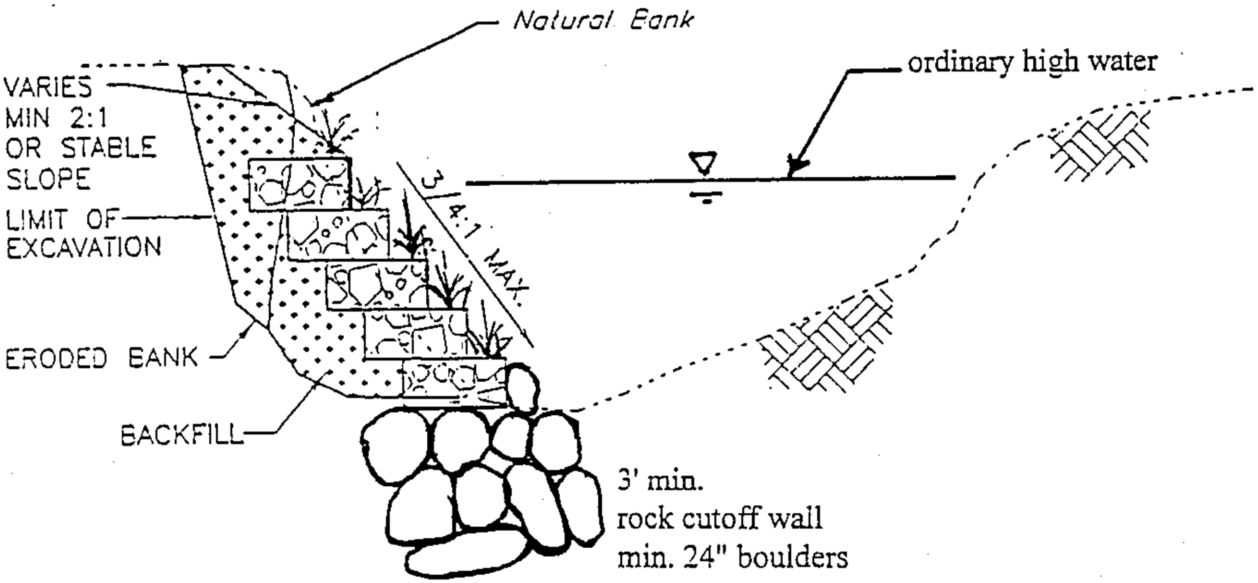
Habitat Impact Assessment:

In-stream: Provide limited biotic resources
Stream-side: Reduce or eliminate biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#9: Stepped Gabions



Section

Bank Protection Measures

#9A: Stepped Gabions with Planting Areas

Description:

This method consists of large wire baskets filled with rocks and placed on channel banks stacked in layers that resemble steps. The layers are stacked, one on top of the other, until the ordinary high water surface level is reached. A rock cutoff wall is required if channel invert protection is not provided to prevent undermining the structure.

Gabions are revegetated using planting boxes. Planting boxes are gabion cells that are left open to bare soil and revegetated with shrubs and trees. Irrigation is provided to the planted vegetation to aid plant establishment. The gabion baskets themselves can sometimes naturally revegetate, if adequate water and soil are available.

Design Criteria:

Appropriate for slopes from 0.75 to1 up to 3 to 1.

Appropriate for velocities up to 6 feet per second.

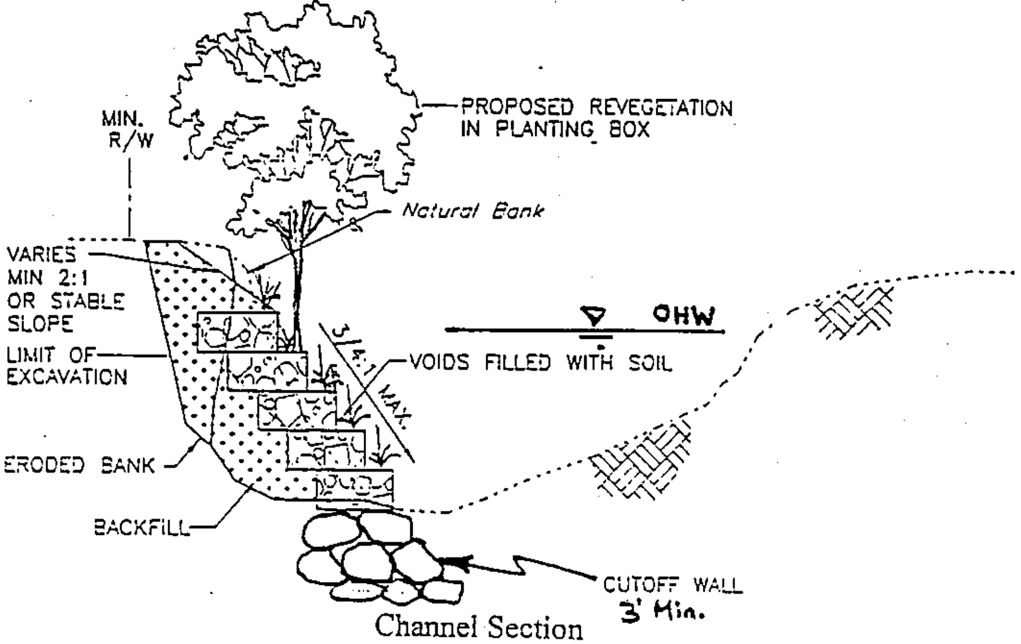
Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Reduces or eliminates biotic potential

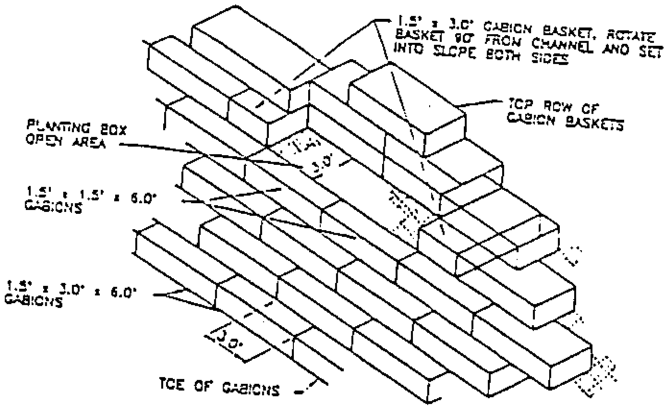
See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#9A: Stepped Gabions with Planting Areas

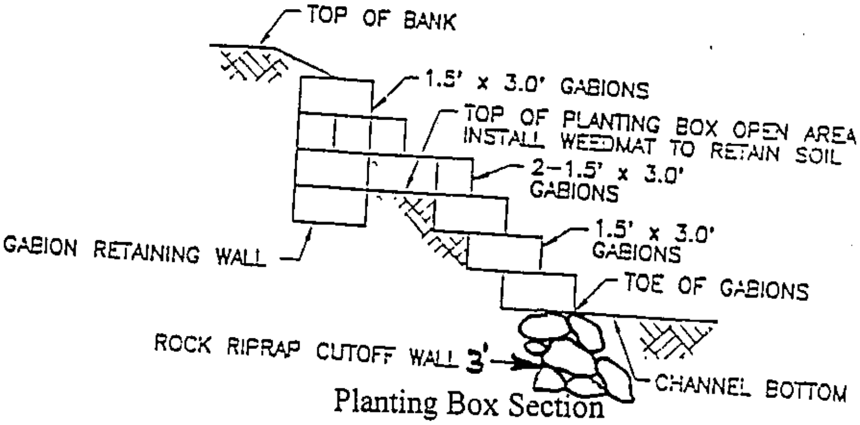


Channel Section



1.5' x 3.0' GABION BASKET, ROTATE BASKET 90° FROM CHANNEL AND SET INTO SLOPE BOTH SIDES
TOP ROW OF GABION BASKETS
PLANTING BOX OPEN AREA
1.5'
3.0'
1.5' x 1.5' x 6.0' GABIONS
1.5' x 3.0' x 6.0' GABIONS
3.0'
TOE OF GABIONS

Planting Box Detail



Planting Box Section

Bank Protection Measures

#9B: Stepped Gabions with Planting Areas and Vortex Rock Weirs

Description:

This method consists of large wire baskets filled with rocks and placed on channel banks stacked in layers that resemble steps. The layers are stacked, one on top of the other, until the design water surface (ordinary high water or other) is reached. A concrete, gabion, or rock cutoff wall is required if channel invert protection is not provided to prevent undermining the structure.

Gabions can be revegetated using planting boxes. Planting boxes are gabion cells that are left open to bare soil and revegetated with shrubs and trees. Irrigation is provided to the planted vegetation to aid plant establishment. The unplanted gabions can sometimes naturally revegetate, if adequate water and soil are available.

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1]. Weirs should be placed on the downstream end of erosion protection structure to help maintain profile.

Design Criteria:

Appropriate for bank slopes from 0.75 to1 up to 3 to 1.

Appropriate for velocities up to 6 feet per second.

Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream:	Provides limited biotic potential
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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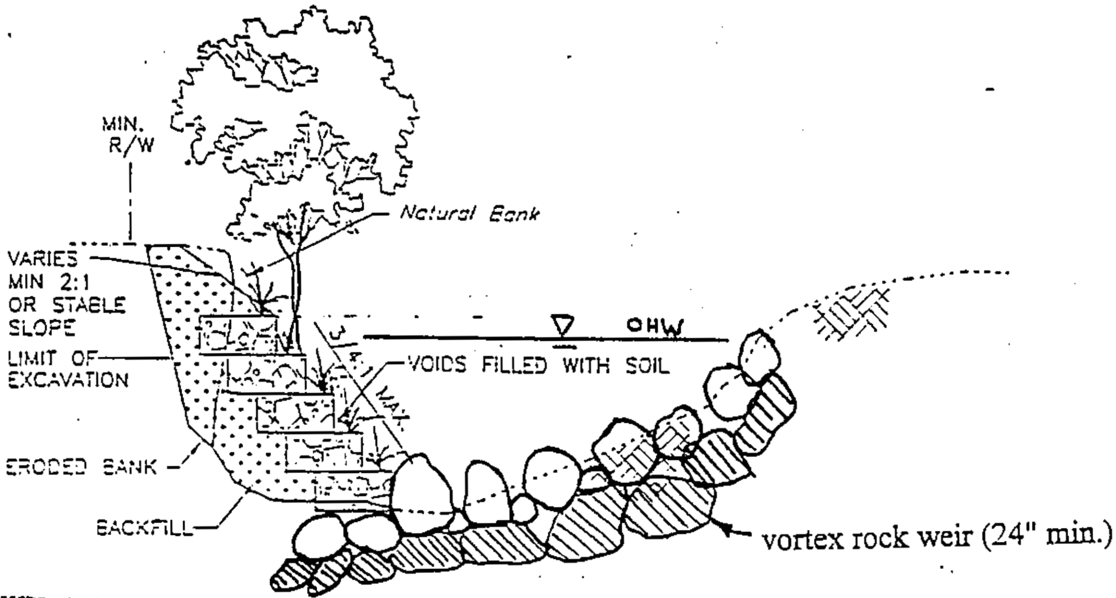
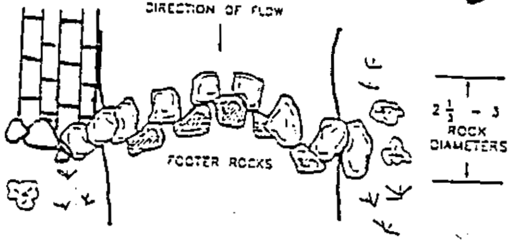
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

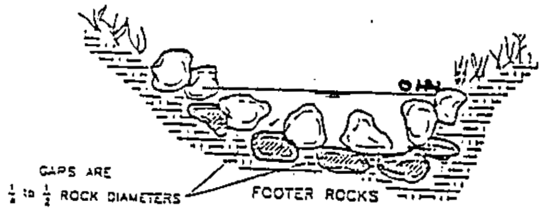
#9B: Stepped Gabions with Planting Areas and Vortex Rock Weirs



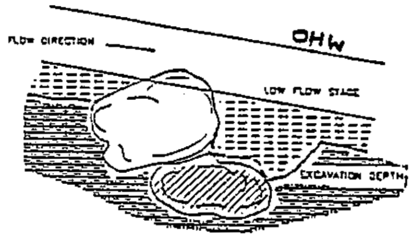
Channel Section



plan view

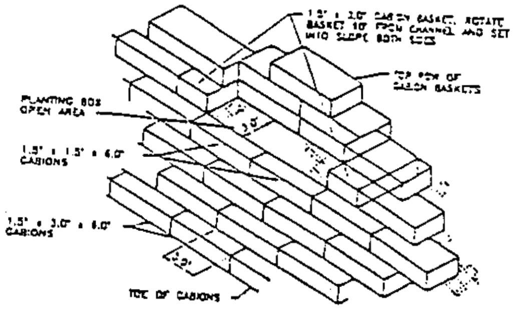


cross section

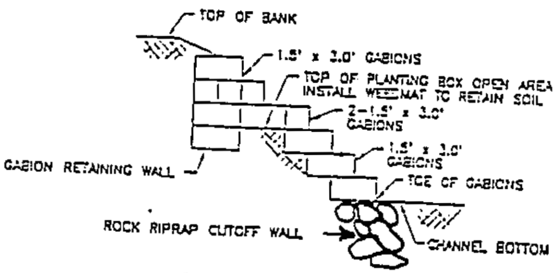


profile view

Vortex Weirs: Plan, Section, and Profile


1.5' x 3.0' GABION BASKET, ROTATE BASKET 90° FROM CHANNEL AND SET INTO SLOPE BOTH SIDES
TOP ROW OF GABION BASKETS
PLANTING BOX OPEN AREA
3.0'
1.5' x 1.5' x 6.0' GABIONS
1.5' x 3.0' x 6.0' GABIONS
3.0'
TOE OF GABIONS

Planting Box Detail



Planting Box Section

Source: Adapted from California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#10: Articulated Concrete Blocks

Description:

Articulated concrete blocks (ACB) consists of concrete interlocking blocks that are cabled together to form mats that can be laid on the channel slope and/or channel bottom. The ACB is extended below the invert to form a cutoff wall.

ACBs are available in two styles: open cell and closed cell. The open cell style allows for vegetation to be recruited into the soil filling of the cell. Vegetation growth is restricted by the sizes of the cell openings and by the disconnection caused by the cell walls.

Design Criteria:

Appropriate for slopes up to 1 to 1.

Appropriate for velocities up to 15 feet per second for closed cell ACBs, 6 feet per second for open cell ACBs.

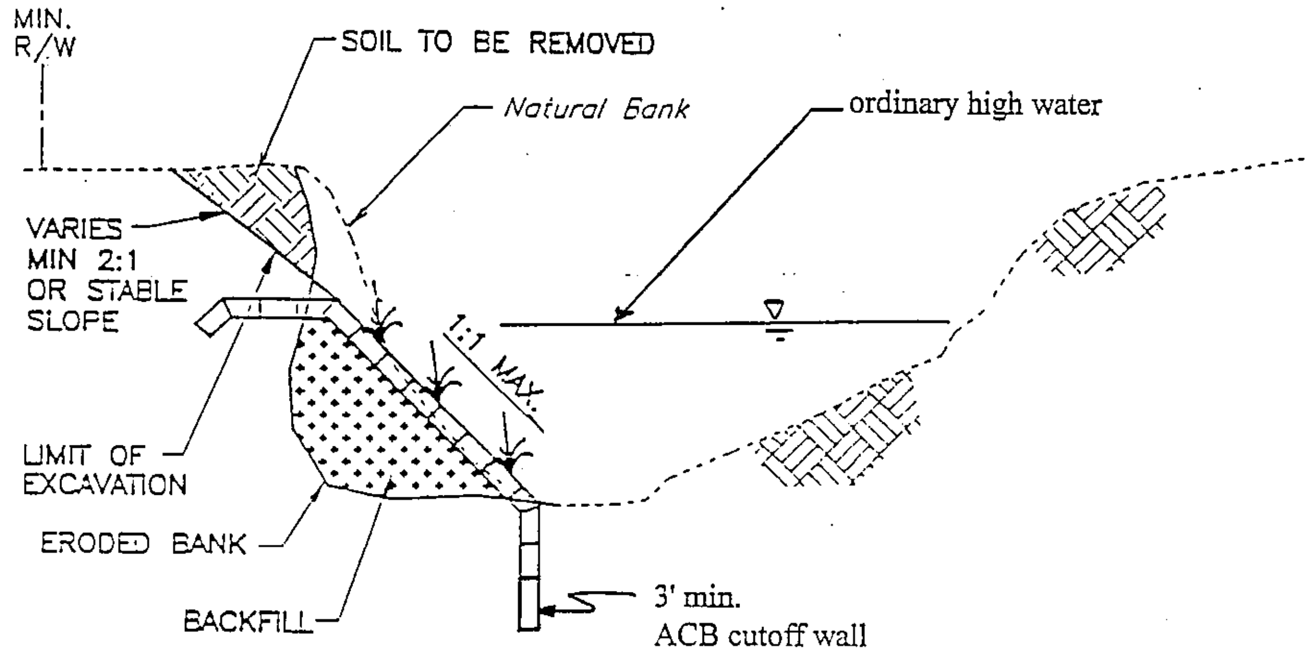
Habitat Impact Assessment:

In-stream:	Provide limited biotic resources
Stream-side:	Reduce or eliminate biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#10: Articulated Concrete Blocks



Section

Bank Protection Measures

#10A: Articulated Concrete Blocks with Planting Areas

Description:

Articulated concrete blocks (ACB) consists of concrete interlocking blocks that are cabled together to form mats that can be laid on the channel slope and/or channel bottom. The ACB is extended below invert as a cutoff wall to prevent undermining of slope protection.

ACBs are available in two styles: open cell and closed cell. The open cell style allows for vegetation to be recruited into the soil filling of the cell. Vegetation growth is restricted by the sizes of the cell openings and by the disconnection caused by the cell walls.

Open planting areas can be constructed into the ACB mats by creating an opening in the mat by removing some of the blocks. The open areas can be revegetated with shrubs and trees. Irrigation is provided to the planted vegetation to aid plant establishment.

Design Criteria:

Appropriate for slopes up to 1 to 1.

Appropriate for velocities up to 15 feet per second for closed cell ACBs, 6 feet per second for open cell ACBs.

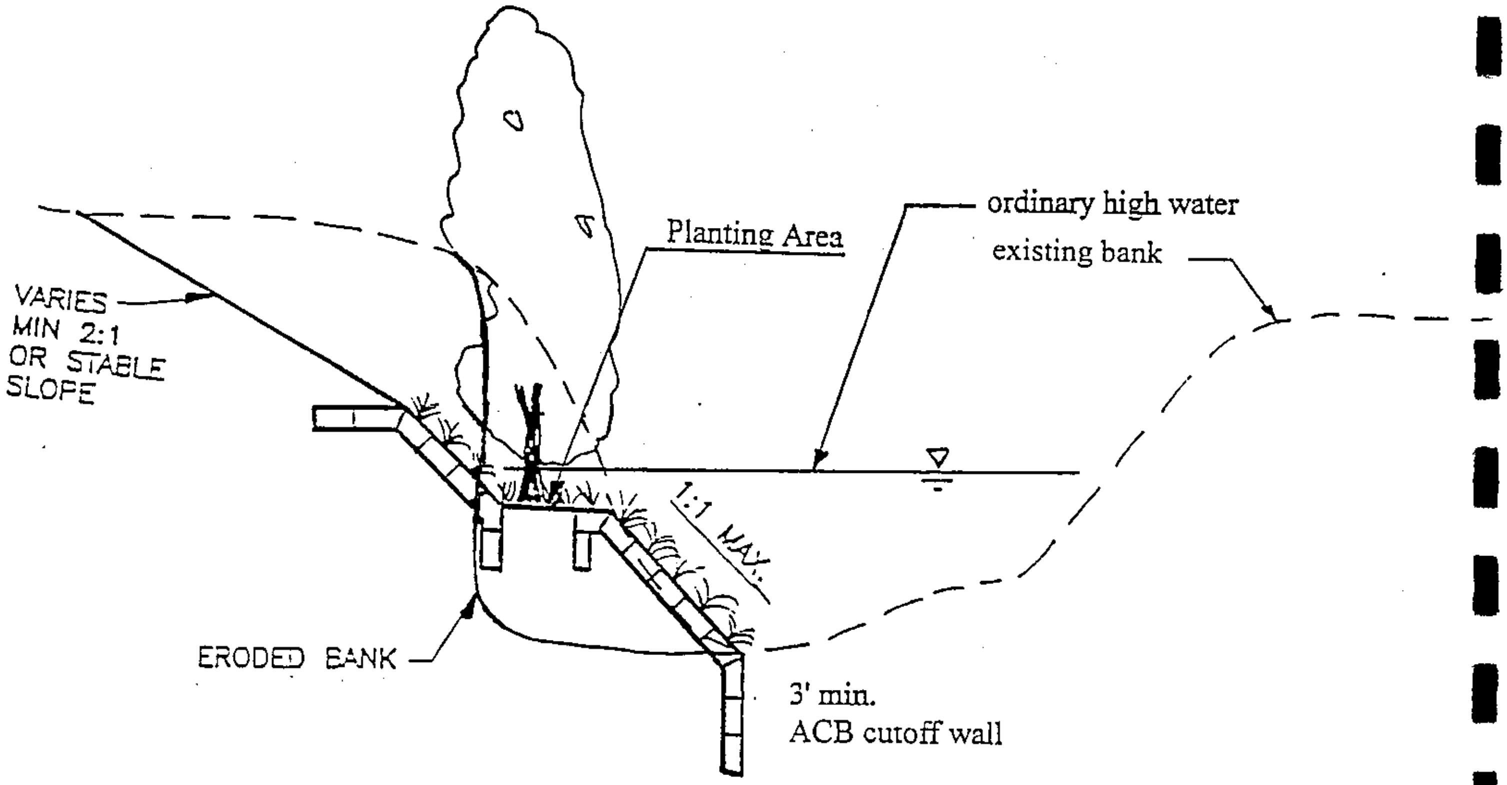
Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#10A: Articulated Concrete Blocks with Planting Areas



Section

Bank Protection Measures

#10B: Articulated Concrete Blocks with Planting Areas and Vortex Rock Weirs

Description:

Articulated concrete blocks (ACB) consists of concrete interlocking blocks that are cabled together to form mats that can be laid on the channel slope and/or channel bottom. The ACB is extended below invert as a cutoff wall to prevent undermining of slope protection.

ACBs are available in two styles: open cell and closed cell. The open cell style allows for vegetation to be recruited into the soil filling of the cell. Vegetation growth is restricted by the sizes of the cell openings and by the disconnection caused by the cell walls.

Open planting areas can be constructed into the ACB mats by creating an opening in the mat by removing some of the blocks. The open areas can be revegetated with shrubs and trees. Irrigation is provided to the planted vegetation to aid plant establishment.

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1]. Weirs are built on the downstream end of bank repair project to help control profile.

Design Criteria:

Appropriate for slopes up to 1 to 1.
Appropriate for velocities up to 15 feet per second for closed cell ACBs, 6 feet per second for open cell ACBs.
Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream:	Provides limited biotic resources
Stream-side:	Provides limited biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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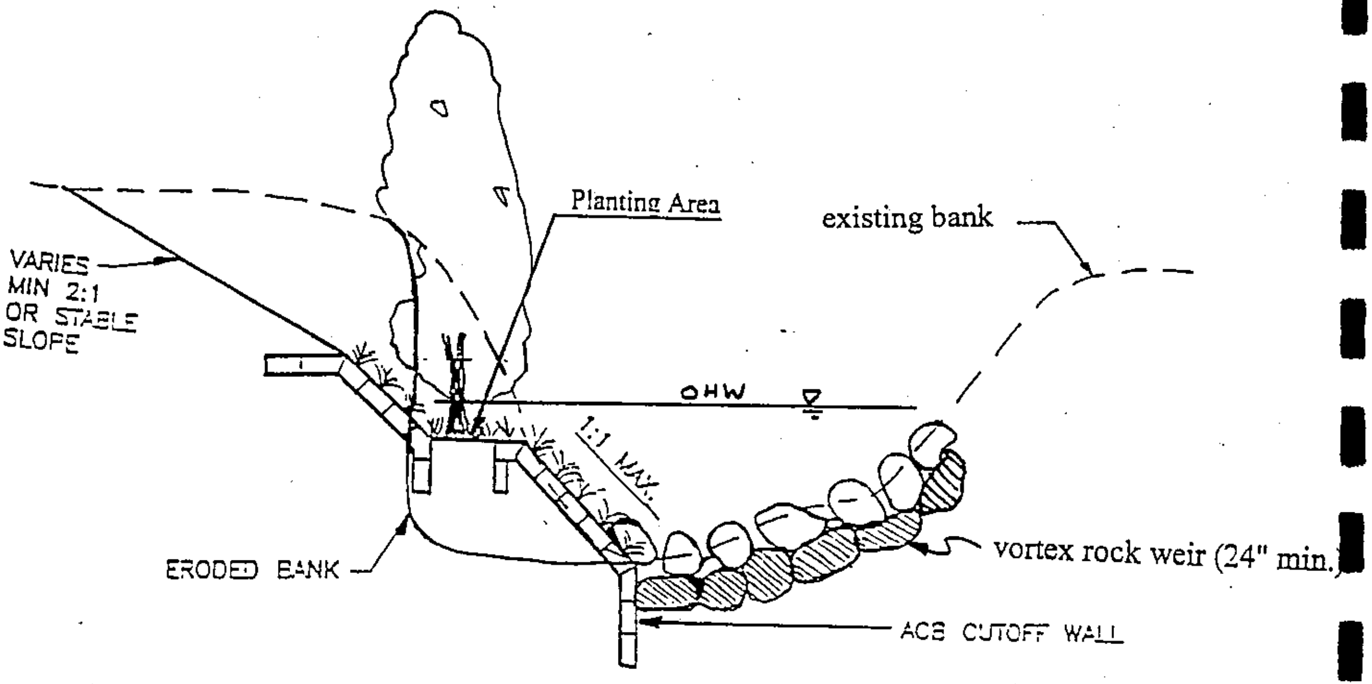
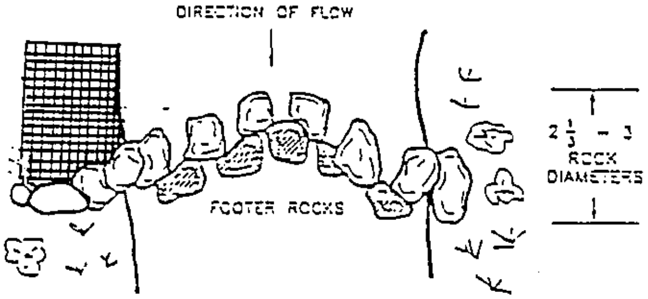
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

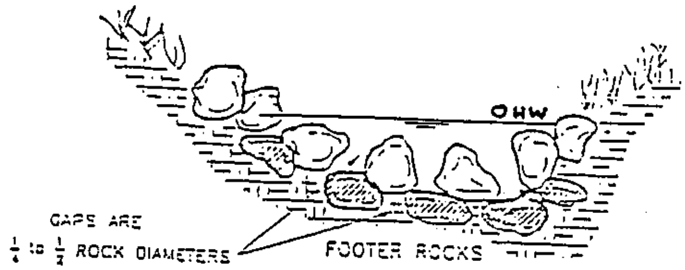
#10B: Articulated Concrete Blocks with Planting Areas and Vortex Rock Weirs



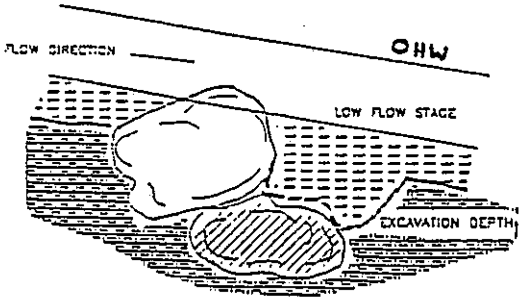
Section



plan view



cross section



profile view

Vortex Weirs: Plan, Section, and Profile

Source: Adapted from California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#11: Concrete Crib Walls

Description:

Concrete crib walls consist of stacked interlocking concrete frames that form a retaining wall. The structural strength is developed by the composite design of a concrete frame with compacted backfill. Crib walls are constructed with open face panels that are planted by live staking. This method restricts plant growth by the size of the panel opening. As the crib wall slope is flattened and the lattice becomes more open, the vegetation potential increases and the allowable velocity decreases because of the exposed soil and vegetation.

Design Criteria:

Appropriate for slopes up to 1/4 to 1.

Appropriate for velocities from 6 feet per second up to 15 feet per second, depending on the size of the crib wall's openings.

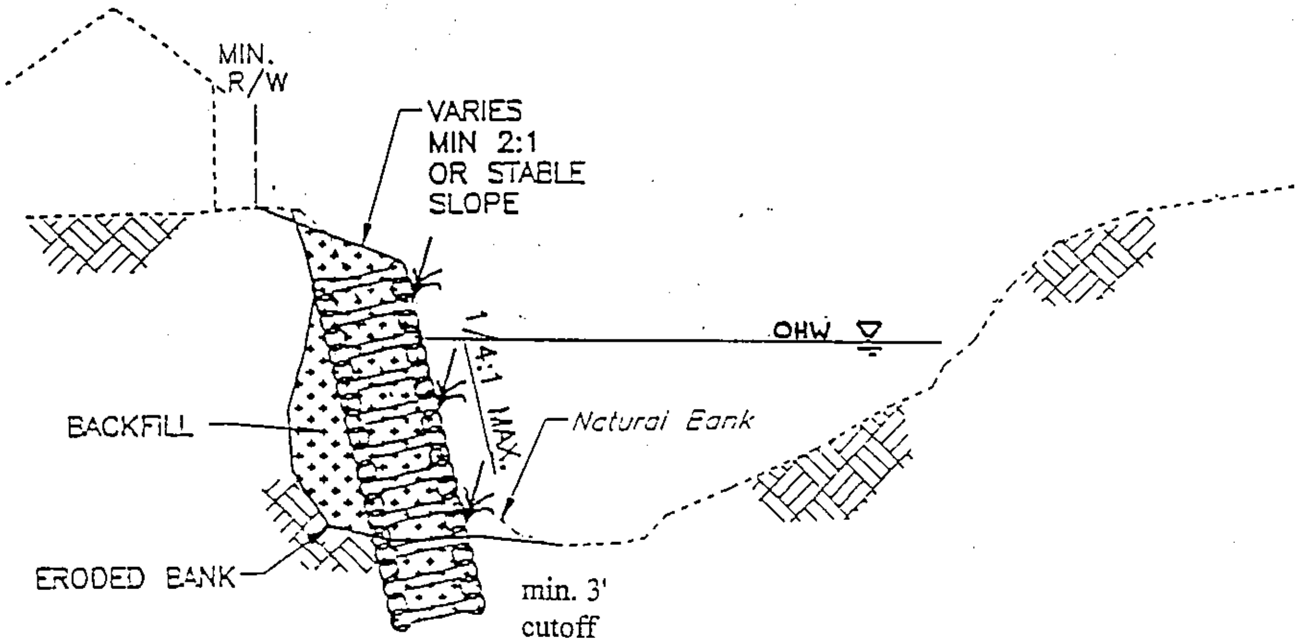
Habitat Impact Assessment:

In-stream:	Reduces or eliminates biotic potential
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#11: Concrete Crib Walls



Section

Bank Protection Measures

#11A: Concrete Crib Walls with Vortex Rock Weirs

Description:

Concrete crib walls consist of stacked interlocking concrete frames that form a retaining wall. The structural strength is developed by the composite design of a concrete frame with compacted backfill. Crib walls are constructed with open face panels that are planted by live staking. This method restricts plant growth by the size of the panel opening. As the crib wall slope is flattened and the lattice becomes more open, the vegetation potential increases and the allowable velocity decreases because of the exposed soil and vegetation.

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1]. Weirs are built on the downstream end of the bank repair project to help maintain profile.

Design Criteria:

Appropriate for slopes up to 1/4 to 1.

Appropriate for velocities from 6 feet per second up to 15 feet per second, depending on the size of the crib wall's openings.

Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream: Provides limited biotic resources
Stream-side: Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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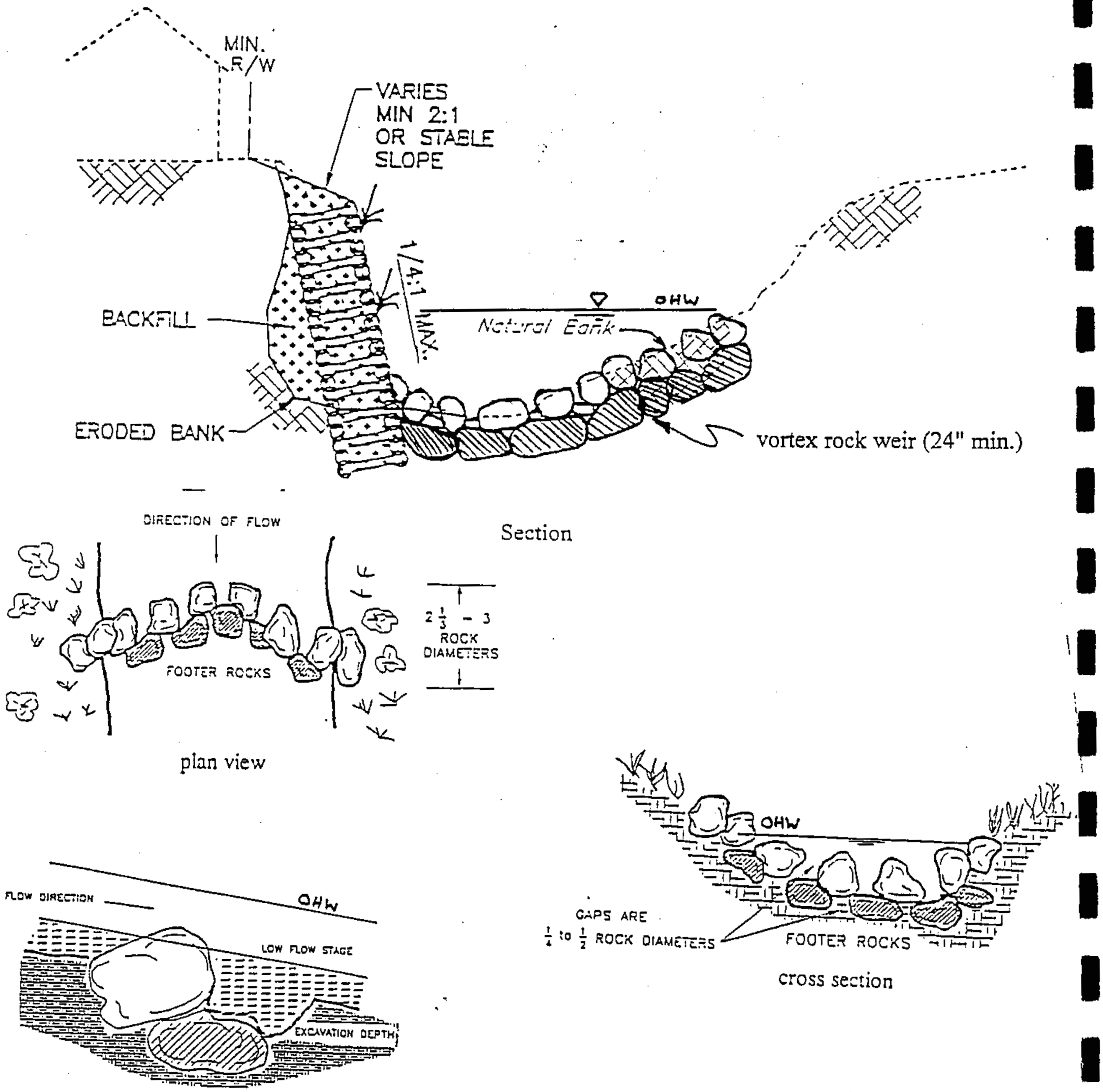
[1] Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#11A: Concrete Crib Walls with Vortex Rock Weirs



Section

plan view

cross section

profile view

Vortex Weirs: Plan, Section, and Profile

Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#12: Live Log Crib Walls

Description:

Log crib walls are used to reduce sediment input and protect banks in areas where logs are available and boulders are not practical[1]. Cribbing provides protection in areas with near-vertical banks where bank sloping options are limited by issues such as right of way restrictions[2]. Cribwalls afford a natural appearance, immediate protection, and accelerate the establishment of woody species[2]. This method is effective on the outside of bends where high velocities are present and in situations where a low wall may be required to stabilize the toe and reduce slope steepness[2]. This method does not adjust to toe scour and should be used in combination with soil bioengineering systems and live plantings to stabilize the upper slopes[2]. Logs should be selected for soundness, durability, uniformity of size, and ease of handling (straight logs much preferred) and delivery.

Two rows of base logs are placed in trenches below stream grade to prevent undercutting of the structure. Base logs should be as large (long and thick) as can be manipulated while conforming to the contour of the stream bank. Good base logs are crucial to ensure stability and durability of the crib wall[1]. Geotextile fabric should be placed behind the structure. Tie-back logs are notched into the base logs and placed at regular intervals (6 to 8 feet typically) along the base logs. Tie-back logs are attached to both rows of base logs using re-bar or cables. There should be at least two tie-back logs connecting each pair of base logs. Once the first row of tie-back logs has been connected, a second set of face logs is placed on top of the tie-backs. These logs are placed approximately 6 inches back into the slope. This procedure is repeated until the desired level of bank protection is achieved. As each lift is constructed, the face logs and tie-backs are filled with a mix of gravel and cobbles to the top of the face log. It is not necessary to use topsoil in the fill material; but there should be sufficient fine grained material to insure vegetation growth. Live cuttings are then laid in to form a complete cover layer. These live branches should be long enough to have their butt ends in the soil behind the crib wall. The tips should stick out of the crib wall no more than a quarter of the cutting total length. The branches are then covered with the gravel/cobble mix to the top of the tie-backs, and the next layer is continued.

Design Criteria:

Appropriate for slopes up to 1/4 to 1.
Appropriate for velocities from 6 feet per second up to12 feet per second, depending on opening size.

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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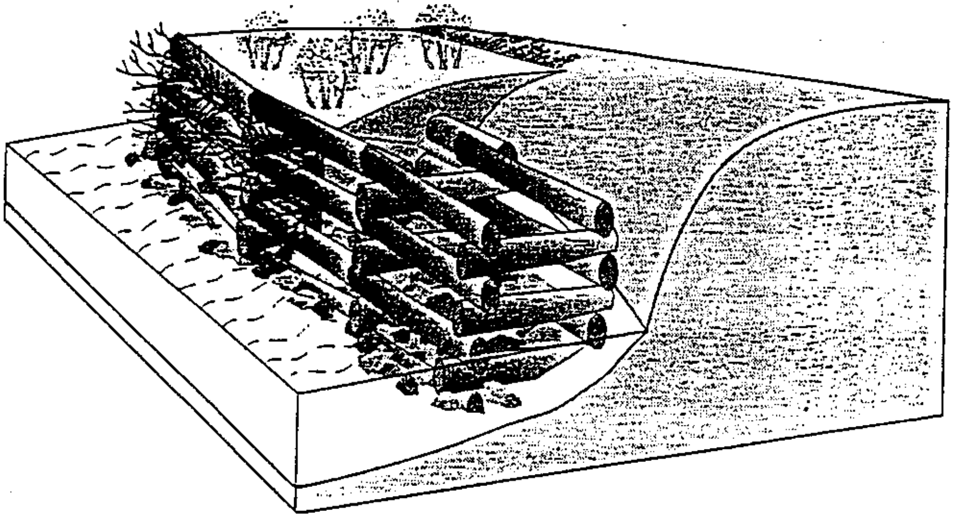
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

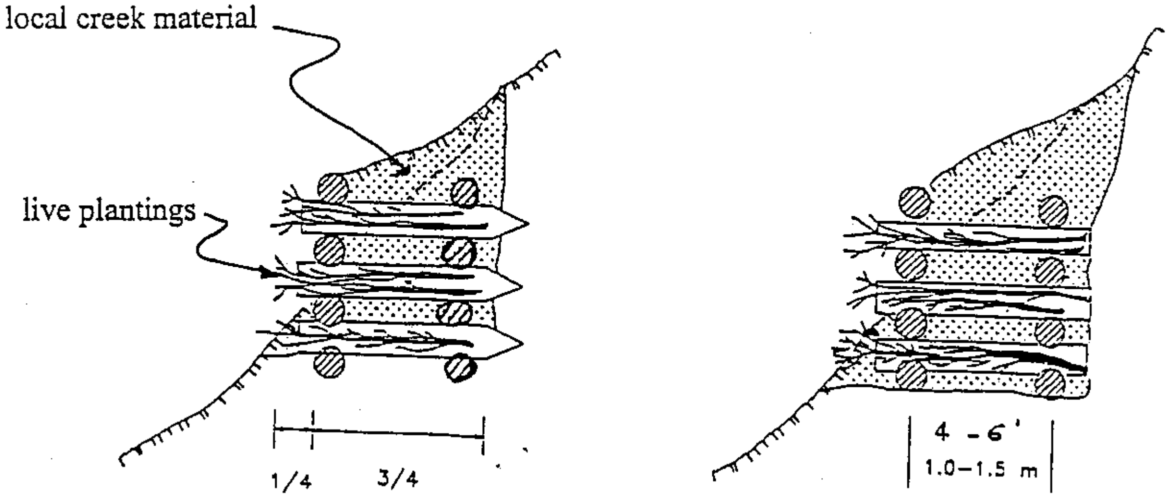
[2] Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices

Bank Protection Measures

#12: Live Log Crib Walls



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles, Processes and Practices



Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#12A: Live Log Crib Walls with Vortex Rock Weirs

Description:

Log crib walls are used to reduce sediment input and protect banks in areas where logs are available and boulders are not practical[1]. Cribbing provides protection in areas with near-vertical banks where bank sloping options are limited by issues such as right of way restrictions[2]. Cribwalls afford a natural appearance, immediate protection, and accelerate the establishment of woody species[2]. This method is effective on the outside of bends where high velocities are present and in situations where a low wall may be required to stabilize the toe and reduce slope steepness[2]. This method does not adjust to toe scour and should be used in combination with soil bioengineering systems and live plantings to stabilize the upper slopes[2]. Logs should be selected for soundness, durability, uniformity of size, and ease of handling (straight logs much preferred) and delivery.

Two rows of base logs are placed in trenches below stream grade to prevent undercutting of the structure. Base logs should be as large (long and thick) as can be manipulated while conforming to the contour of the stream bank. Good base logs are crucial to ensure stability and durability of the crib wall[1]. Geotextile fabric should be placed behind the structure. Tie-back logs are notched into the base logs and placed at regular intervals (6 to 8 feet typically) along the base logs. Tie-back logs are attached to both rows of base logs using re-bar or cables. There should be at least two tie-back logs connecting each pair of base logs. Once the first row of tie-back logs has been connected, a second set of face logs is placed on top of the tie-backs. These logs are placed approximately 6 inches back into the slope. This procedure is repeated until the desired level of bank protection is achieved. As each lift is constructed, the face logs and tie-backs are filled with a mix of gravel and cobbles to the top of the face log. It is not necessary to use topsoil in the fill material; but there should be sufficient fine grained material to insure vegetation growth. Live cuttings are then laid in to form a complete cover layer. These live branches should be long enough to have their butt ends in the soil behind the crib wall. The tips should stick out of the crib wall no more than a quarter of the cutting total length. The branches are then covered with the gravel/cobble mix to the top of the tie-backs, and the next layer is continued.

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1].

Design Criteria:

Appropriate for slopes up to 1/4 to 1. Appropriate for velocities from 6 feet per second up to 12 feet per second, depending on opening size. Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream:	Enhances biotic resources
Stream-side:	Enhances biotic resources

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

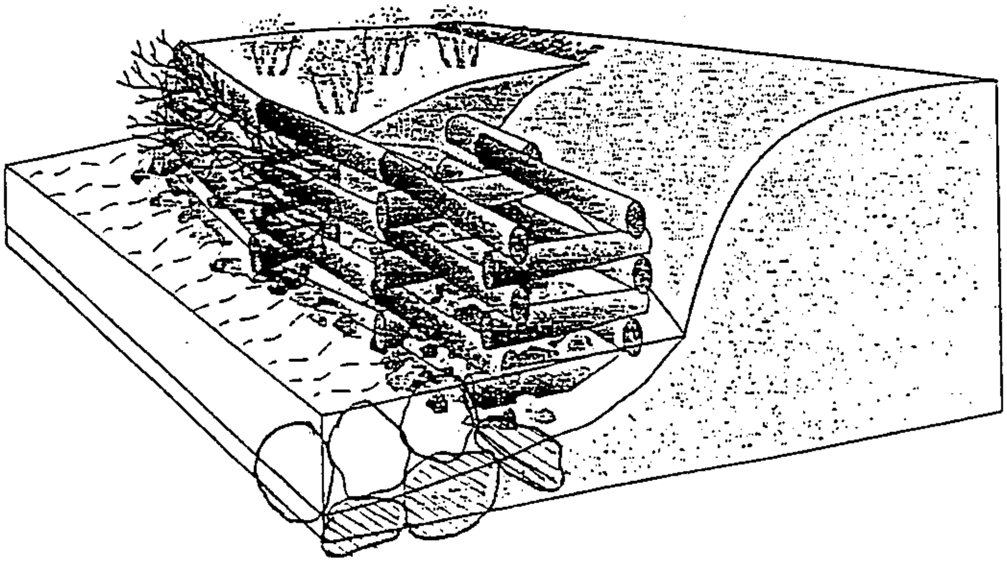
---

[1] Source: California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual

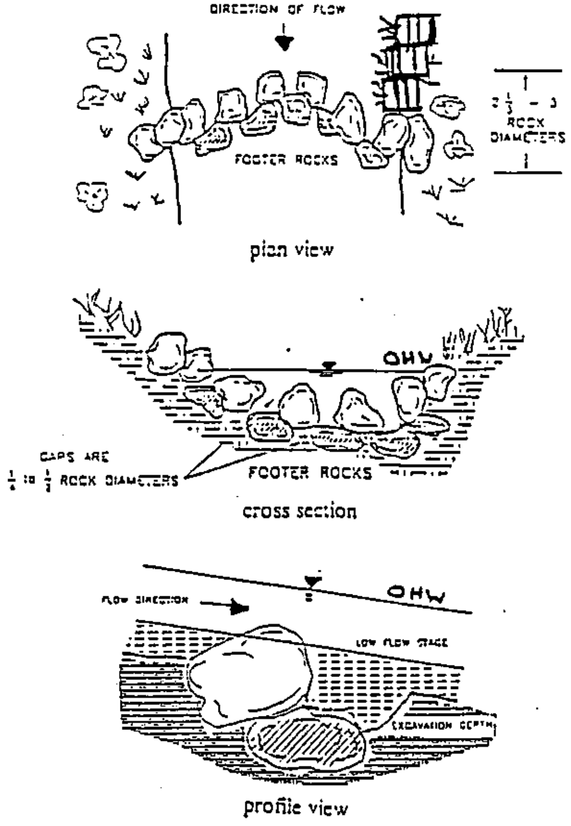
[2] Source: Natural Resources Conservation Service, Stream Corridor Restoration Principles, Processes and Practices

Bank Protection Measures

#12A: Live Log Crib Walls with Vortex Rock Weirs



Source: Natural Resources Conservation Service. Stream Corridor Restoration Principles. Processes and Practices

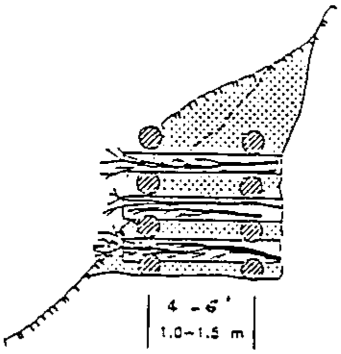


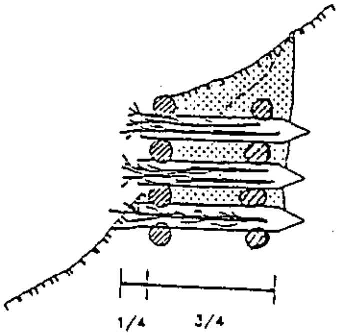
plan view

cross section

profile view

Vortex Weirs: Plan, Section, and Profile





Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures
#13: Sacked Concrete

Description:

Sacked concrete slope protection (SCSP) consists of burlap bags filled with concrete and placed against channel banks. SCSP requires a concrete or SCSP cutoff wall at the toe of the slope to prevent failure. SCSP does not provide any revegetation potential. However, it offers the opportunity to contour walls such that existing vegetation is avoided (tree wells).

Design Criteria:

Appropriate for slopes up to 1/2 to 1.
Appropriate for velocities up to 15 feet per second.

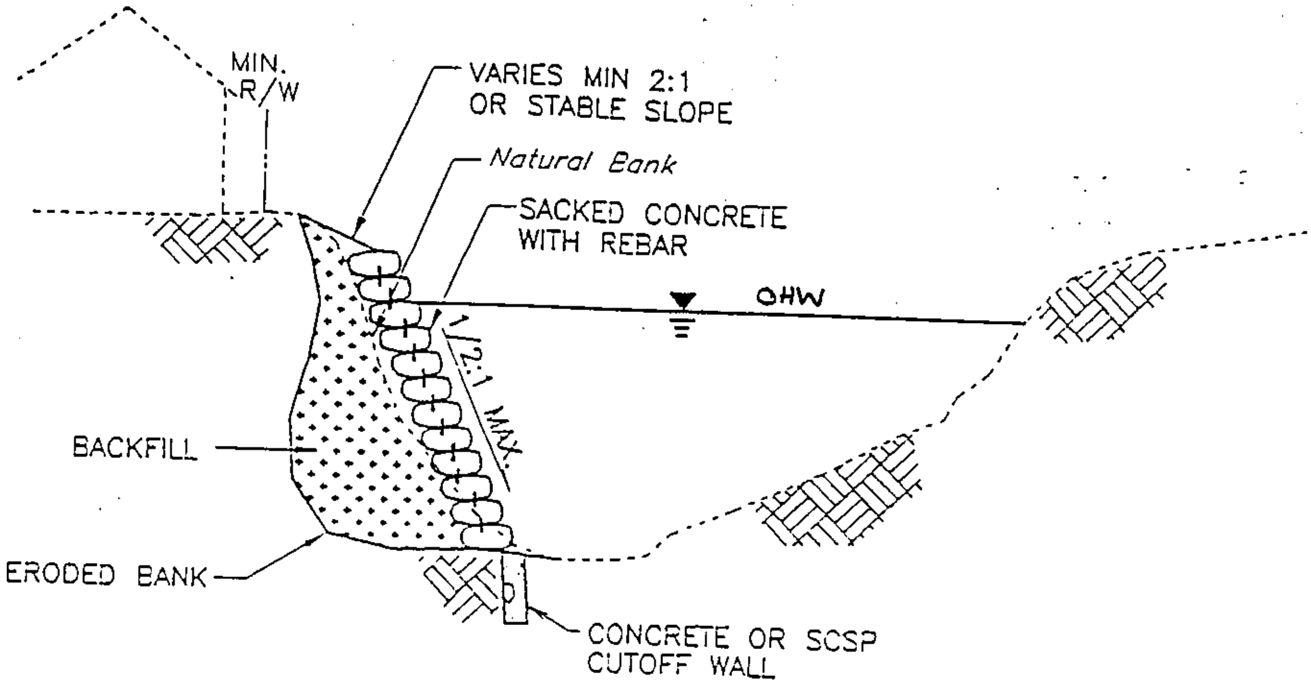
Habitat Impact Assessment:

In-stream:	Reduces or eliminates biotic potential
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Bank Protection Measures

#13: Sacked Concrete



Section

Bank Protection Measures

#13A: Sacked Concrete with Vortex Rock Weirs

Description:

Sacked concrete slope protection (SCSP) consists of burlap bags filled with concrete and placed against channel banks. SCSP requires a concrete or SCSP cutoff wall at the toe of the slope to prevent failure. SCSP does not provide any revegetation potential. However, it offers the opportunity to contour walls such that existing vegetation is avoided (tree wells).

Vortex boulder weirs were designed for use in high bedload streams to maintain sediment transport capacity, maintain low width to depth ratios, and provide habitat. Vortex boulder weirs provide instream cover and deepen feeding areas in riffle habitat, provide a wide range of velocities for salmonid holding water at high flows, act as grade control structures without upstream lateral migration, bank erosion, or aggradation, and maintain a low width/depth ratio to reduce sediment deposition[1]. Weirs are built on the downstream end of bank repair to help maintain profile.

Design Criteria:

Appropriate for slopes up to 1/2 to 1.

Appropriate for velocities up to 15 feet per second.

Vortex weirs are most appropriate in "F" and "B" type channels, according to Rosgen's stream classification system[1].

Habitat Impact Assessment:

In-stream:	Reduces or eliminates biotic potential
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

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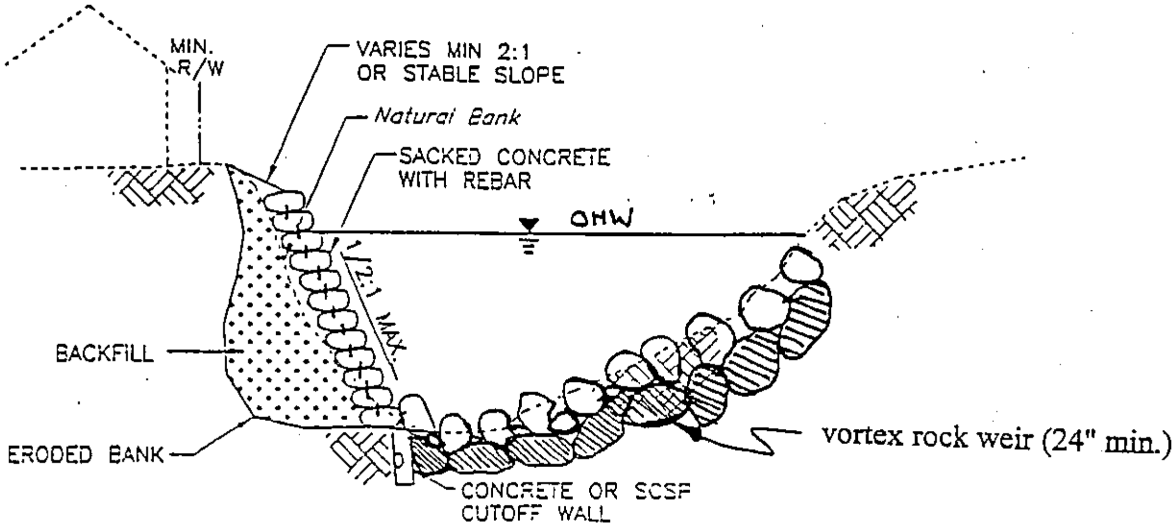
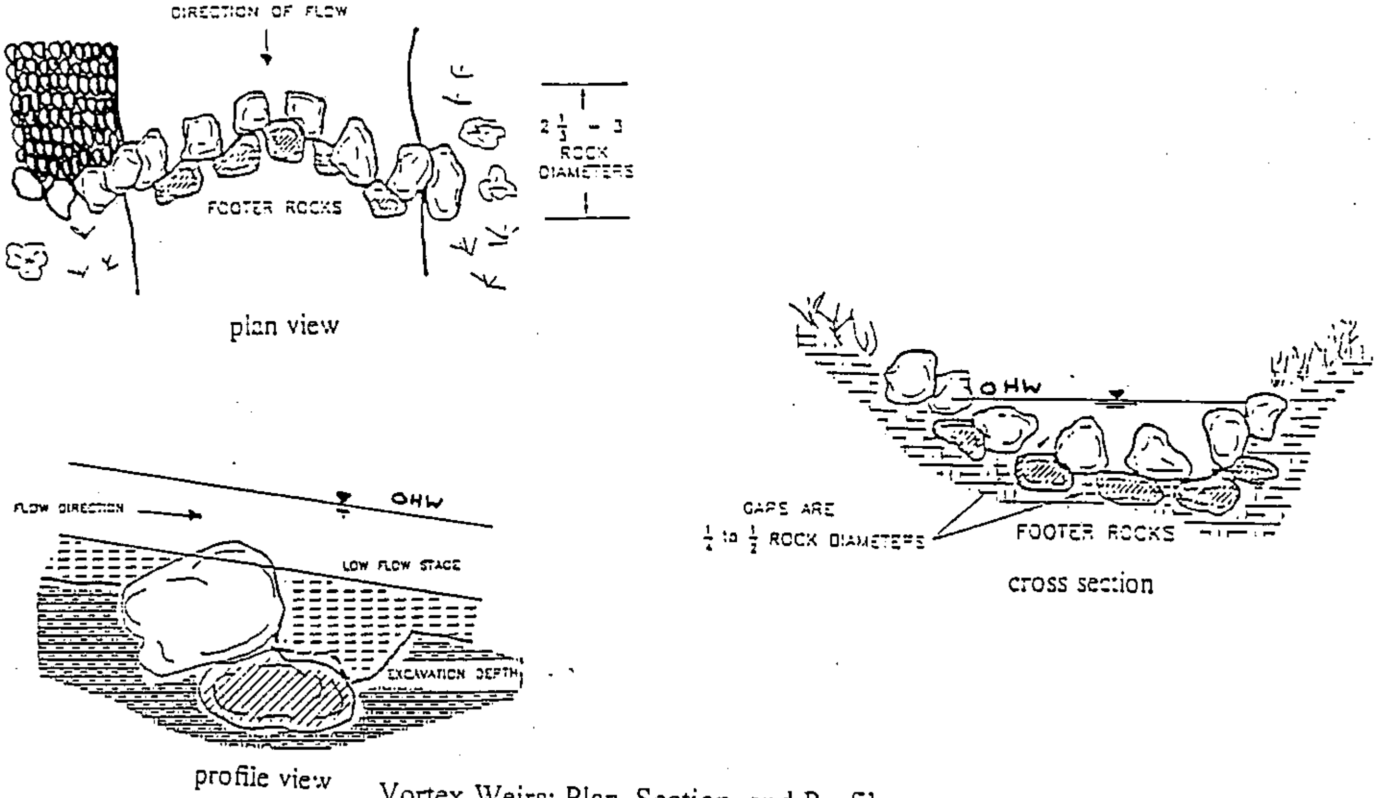
[1] Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#13A: Sacked Concrete with Vortex Rock Weirs


MIN. R/W
VARIES MIN 2:1 OR STABLE SLOPE
Natural Bank
SACKED CONCRETE WITH REBAR
OHW
1/2:1 MAX
BACKFILL
ERODED BANK
vortex rock weir (24" min.)
CONCRETE OR SCSP CUTOFF WALL

Section



plan view

cross section

profile view

Vortex Weirs: Plan, Section, and Profile

Source: California Department of Fish and Game. California Salmonid Stream Habitat Restoration Manual

Bank Protection Measures

#14: Gunite Slope Protection

Description:

Gunite slope protection consists of a concrete mixture sprayed under presssure over an eroded bank. Reinforcing steel may be placed against the bank prior to spraying.

Design Criteria:

Appropriate for slopes up to vertical.

Appropriate for velocities up to 15 feet per second.

Habitat Impact Assessment:

In-stream:	Reduces or eliminates biotic potential
Stream-side:	Reduces or eliminates biotic potential

See SMP, Appendix E, Bank Protection Assessment Matrix for assessment details.

Attachment D
Sensitive Plants, Wildlife, and Fish at Your Worksite

Attachment E
Compensatory Mitigation Site Selection Criteria for California Red-legged Frogs

Attachment E

Compensatory Mitigation Site Selection Criteria for California Red-legged Frogs

The District has committed to a compensatory mitigation program for California red-legged frog which consists of preserving 108 acres of suitable land for red-legged frog. A least two sites will be selected for mitigation. At least one site will be located in each of the two local mountain ranges, the Diablo and Santa Cruz Mountains. Selecting two sites will facilitate maintenance of RLF populations in both mountain ranges.

The lands acquired for the RLF mitigation will be acquired under the SMP's Stream and Watershed Protection Program. The Stream and Watershed Protection Program is a compensatory wetland mitigation element which includes the purchase and protection of stream and associated watershed lands and a smaller element for restoration of the acquired or other similar lands.

The Stream and Watershed Protection Program is projected to acquire from 820 to 1080 acres of land. Most of the lands acquired for the Stream and Watershed Protection Program are expected to meet the criteria for red-legged frog mitigation. Each parcel considered for purchase by the Stream and Watershed Protection Program will be evaluated to determine its suitability for purchase, as described in the Stream and Watershed Protection Program Mitigation and Monitoring Plan. Those parcels that qualify for purchase under the Stream and Watershed Protection Program will then be evaluated to determine their suitability for red-legged frog mitigation. The purchased acres that meet both the Stream and Watershed Protection Program and red-legged frog mitigation program's criteria will provide mitigation for both wetland and red-legged frog impacts.

To ensure that lands purchased for compensatory mitigation for California red-legged frog impacts are suitable for the species, a series of criteria has been established. This criteria was developed in part based on the U.S. Fish and Wildlife Service Draft Method for determining the number of available credits for California Red-legged Frog Conservation Banks dated 3 February 2000; the Draft recovery plan for the California Red-legged Frog (*Rana aurora draytonii*) dated January 2000; and the final rule designating California Red-legged Frog Critical Habitat (Federal Register 66: No 49 Tuesday March 13, 2001).

The criteria have been developed in three parts; presence of frog population; suitability of habitat; and ability to manage the site for the benefit of the frog over the long-term. Each part must receive a positive response for the parcel to be considered for California red-legged frog mitigation. The response to each part must consider economic, ecological, and technical feasibility of protecting the site.

Part A. Species Present or Can Be Returned to Site

Areas considered for habitat protection for California red-legged frogs must have an existing population of red-legged frogs or conditions must be suitable for the species to colonize the site or be successfully reintroduced to the site. The presence of an existing population will be confirmed by survey. If no frogs are found on-site during the survey, then an evaluation of the habitat must be conducted. The results of this habitat assessment must confirm that suitable habitat for the species is present on-site. If suitable habitat is present, a second assessment must be conducted to evaluate how red-legged frogs may be returned to the site. This evaluation must consider colonization without human intervention and reintroduction using various methods. The USFWS and the CDFG must approve any reintroduction before it is implemented.

Part B. Habitat Suitability

Sites selected for protection of California red-legged frogs must have habitat suitable for the species to occupy at the time of purchase, or the habitat can be created or rehabilitated within a short time period. Suitable habitat contains a variety of features which are used by the frogs during different times of the year. Ponds or deep water pools (maximum depth greater than 0.7 m) must be present from January through July of each year to facilitate reproduction. These pools may be vegetated or vegetation free. Structural complexity of the pond or deep water pools is a benefit. Habitat along the water margin may consist of herbs, shrubs or woodlands.

The areas immediately surrounding the ponds or pools and extending out 100 m should have a variety of refugia sites. These refugia may be used during either the summer or winter months. Summer refugia are deep enough to prevent desiccation and may support limited feeding. Winter refugia are suitable to escape high winter flows in stream environments. The area between the refugia and the aquatic habitat should have enough cover to protect the frogs from terrestrial predators.

Part C. Site Can Be Managed for Frogs over the Long Term.

Sites selected for California red-legged frog mitigation must be able to support red-legged frogs over the long-term. This requires that adjacent land uses are compatible with protection of the species and that future land uses will also be compatible. The parcels selected must be large enough to support all life history phases of the species. The core habitat area must be able to be protected from excessive disturbance by casual or unauthorized uses.

Management of the site over the long-term requires the protection and reliability of water sources. This includes not only a consistent supply of water, but also the quality of water must be sufficient for the frogs to survive. Water supplies threatened by upstream developments, diversions, or non-point pollution may not be suitable. Water supplies which support large numbers of predators including non-native fish and bullfrogs will not be appropriate (this includes imported water sources where eggs or small fish may be transported by pipeline).

Human use of the site is not necessarily restricted, but may be restricted if the use extends beyond authorized established trails. Volunteer trails, trampling of bank vegetation, and in-water recreation activities are not suitable for California red-legged frog mitigation sites.

Grazing may be compatible with protection of California red-legged frogs and may help to alleviate pressures for urbanization or other development of adjacent parcels. Excessive livestock use leading to diminution of water quality or excess erosion is incompatible with protection of California red-legged frogs. Use of the site by feral animals such as pigs must be monitored closely. Rooting and wallowing which leads to water quality problems or destruction of refugia sites must be controllable.

Attachment F
Dryback/Fish Relocation Operation Guidelines

ATTACHMENT F

DRYBACK/FISH RELOCATION OPERATION GUIDELINES

(Working Copy)

These procedures were designed to respond to both planned and non-planned drybacks on streams and other water bodies within the SCVWD jurisdictional purvey. The goal of such response efforts is to recover fish and wildlife resources that are at risk due to normal District operations or extraordinary (accidental) environmental circumstances, thus minimizing potential impacts on natural resources. The overall strategy is to capture native organisms in areas where water is removed and relocate them to other perennial water. Reconnaissance and operational guidelines for planned and unplanned dryback events are provided in the following sections.

The guidelines are established to effect a safe and orderly response to a potentially rapidly evolving environmental condition and thus each element should be viewed as modifiable by the best field judgment for implementation to adapt to the immediate circumstances.

Emergency (Unplanned) Dryback Operations:

Upon notification that an emergency or unplanned dryback is in progress or has occurred, on-call District biologists will be dispatched to the site. A member of the biological staff with a current scientific collecting permit must be on site before fish rescues may be attempted. Upon arrival at the site, District personnel will evaluate the extent of the dryback and determine if there will be any immediate or foreseeable impacts to fish and wildlife on the stream. The extent of the dryback will be documented with photos of the site. Mobilization efforts will be determined as per best judgment and effected on an "as-possible" basis according to the elements of a Planned Dryback.

Planned Dryback Operations:

Prior to a planned dryback operation, various planning and pre-operation efforts may be implemented. The schedule of elements is based on the extent of the dryback, species at risk, lead time available and local site conditions. A live well will be available for relocation efforts in which fish must be moved considerable distances. All required gear is designated operation specific, so that it is available when needed.

Pre-Operation Steps:

I. Background Information.

Determine, if possible, reason(s) rescue needs to occur and be able to communicate this information to resource agencies, public, and media.

II. Pre-operation Survey.

A reconnaissance survey of the dryback zone is conducted by staff biologists to establish an operational response. Depending on the species and site, fish and aquatic wildlife may need to be transported to various release sites. A variety of elements to be considered in executing a fish resource relocation operation include:

A. Pre-sampling of the dryback zone to establish species occurrence and distribution.

B. Staging areas are identified. Sites should be selected on the basis of proximity and access to the dryback zone and safe operation of equipment.

C. Collection and transport methods determined per site conditions. Methods selected to maximize efficiency of collection effort while minimizing handling and transport time/stress. Local transport of fish may be effected by various methods including:

    1. Net transfer. Appropriate for short distances where rapid transfer is possible.
    2. Live car. Appropriate for temporary holding in stream and short distances where rapid transfer is required.
    3. Bucket. Appropriate for temporary holding and transport over short-medium distances. Holding time should be minimized if possible or supplemental aeration supplied.

D. Potential relocation sites identified, with priority given to proximity to dryback zone first within the stream; second within the watershed. In all cases, the closest site that is likely to result in a successful rescue will be used.

1. Downstream vs. Upstream. Species rescued will be transported downstream, if possible, and upstream only for short distances if downstream sites are not feasible.
2. Disease Considerations. Fish will not be moved over substantial barriers or long distances upstream to avoid problems with disease transmission.
3. Anadromous Fish. Given the right conditions at release site(s), salmonid fry should be moved upstream to a point of perennial running water; smolts should be moved downstream to flow that runs continuously to the bay; and that adults should be moved according to their spawning condition: upstream to perennial flow for unspawned fish and downstream to flow that runs continuously to the bay for spawned fish.

E. Transport routes are identified.

F. Prioritization of species and collection/relocation sites is to be made from the information developed in A-E, according to the following schedule:

1) Endangered species
2) Threatened species
3) Species of special concern
4) Salmonids not under the above categories (i.e. resident rainbow trout)
5) Native fishes not under the above categories
6) Non-native fishes if appropriate (for planned rescues, coordinate with "soup kitchen" type organizations to donate if rescue locale is "clean"-no Guadalupe River watershed fishes.)

III. Resource Agency Contact.

A point person is established to contact appropriate resource agencies (typically collecting permittee and 24 hours ahead of time if possible) on operation specifics and to confirm disposition instructions per items II. C, D, F.

IV. Media and Public Relations.

A point person(s) for media coverage is identified to develop media information and coordinate appropriate onsite media activities to minimize on-site risk to press and onlookers during operations.

V. Operational logistics

A. All necessary equipment is identified and checked. This may include "non-standard" items for fish collection and transport.

B. Determine if pumping activities are necessary and begin as early as possible and timed for maximum benefit for relocation efforts.

C. Multiple transport vehicles will be arranged to be on site to minimize holding time and fish stress.

D. Operation personnel are contacted and confirmed for the degree of mobilization required.

Operation Steps

I. Set Up.

Upon arrival at the site, a review of operation sequence and logistics is effected. Field assignments are designated. Equipment is deployed. Prior to commencement of operations, review of safety and operation methods is conducted. Elements may include: site access considerations; local hazards; environmental considerations; media and public safety; equipment operation; risks associated with collection methods.

II. Media Contacts and Events.

Coordinated media events are conducted to minimize disruption to operation logistics and timing and maximize safety to participants. Isolation of media activities out of channel is preferred. For safety, media personnel are to be escorted by designated representatives if in-channel or close proximity events are staged.

III. Live Well Operation.

If used, set up of live wells should commence early on in the operation and deployment to set and stabilize tank conditions.

A. Local native water will be used to fill live wells if available and clean.

B. Temperature and oxygen levels will be monitored in live wells during loading and transport:

1. Temperature of live wells will be reduced and managed at 5 -10_F below ambient water to lessen the stress in fish (slightly lowered temperature slows metabolism thereby reducing oxygen demand and ammonia production but at the same time avoiding thermal shock).
2. Live well aeration system will be started prior to placing fish to ensure that sufficient oxygen is present during the adjustment period. The aeration rate and number of fish in a live well will be managed such that the dissolved oxygen concentration in live wells will be greater than 6ppm but less than saturation.

C. Salmonids will be transported separately from other fish to reduce stress and handling time.

D. To reduce stress in salmonids, at times, a 0.8-0.9 ppt salt solution (never exceeding 1.0 ppt), may be used in live well operation to relax the osmotic stress and better manage crowded conditions. This treatment will also help rid the fish fungal and bacterial agents. This will be administered and managed by trained District Biologists.

IV. Electrofishing Operation.

When electrofishing equipment is used, unit settings will be adjusted to the conductivity and temperature of the water to minimize possible fish injury. Electrofishing settings will initially be set for either varying width (wide to narrow) or varying frequency (high to low) to minimize possible fish injury. Settings used will be recorded and any incidental electrofishing mortalities will be recorded. If electrofishing mortalities for salmonids begin to exceed 5 % of the total capture, electrofishing activities will cease. Fish other than salmonids (i.e. Sacramento suckers), that are mortalities from electrofishing activities will be noted as an indicator of possible injury or mortality rate to salmonids and other fish (Sacramento suckers and other minnow species are more susceptible to electrofishing injury and mortality than other species).

V. General Collection Guidelines.

Collection of fishes will be effected in a manner to minimize handling time and stress, yet maintain the safety of the ground personnel.

A. Multiple buckets and/or live cars will be used to reduce crowding during collection and transfer.

B. Pre-sorting fish will be conducted on an "as-possible" basis as they are captured for transport to a live well.

C. Buckets that hold salmonids until subsequent release into the live wells for transport will be equipped with portable aerators.

VI. Transport.

A. Transport of fish will be effected to minimize holding time and alternately sequenced in tandem with ongoing collection activities.

B. Transportation of relocated fish should be by District personnel only. A District Biologist with appropriate permits will accompany all transport operations.

C. Normal live-well operations should be continued during transport.

D. Mobile communications should be carried in transport vehicles.

VII. Records and Data.

Documentation of fish relocation efforts should be effected at the time of operations.

A. Fish should be inventoried and other pertinent specimen data recorded if circumstances allow. If conditions preclude inventory, a list of the species present and an estimation of their abundance should be documented along with their disposition (i.e. released, mortality(+reason), sacrificed, salvaged).

B. Information on ambient site conditions, including photo-documentation at collection and release sites should be gathered.

C. Information on collection and handling methods and transport conditions should be recorded.

Post-Operation Steps

I. Evaluation.

As part of the demobilization an informal assessment of the operation will be made. Information on strengths and weakness will be synthesized in operation records for future adjustments and as inclusions in operation reports as needed.

II. Reporting.

A report on the cause or need of the dry back with the fish rescue results accompanied by an impact evaluation on the resource-this report should include photo documentation. This report will be kept on file and copies forwarded to the appropriate resource agency(ies) as needed.

Attachment G
Urban Runoff Pollution Prevention Efforts by District

Attachment G
Urban Runoff Pollution Prevention Efforts by District

Urban Runoff Pollution Prevention for District Operations

1. **Channel Maintenance Projects.** The District continues to implement BMPs while conducting sediment removal and bank protection projects. Stream maintenance permits are obtained from the US Army Corps of Engineers, Department of Fish and Game, and Regional Water Quality Control Boards. The District also prepares and implements field sampling of water quality and sediment to ensure that water quality is preserved during maintenance activities and sediment can be reused or disposed of properly.

2. **Pollution Prevention during Construction of Capital Improvement Projects.** District's construction contract specifications include provisions regarding erosion control. These provisions are modified on a site-by-site basis, but they generally require the contractor to prepare and implement a Storm Water Pollution Prevention Plan as described in the Storm Water NPDES Permit for Construction Activities.

3. **Management of Runoff on District Facilities.** The District has developed or is in the process of developing Storm Water Pollution Prevention Plans for its facilities. Facilities and their storm drain systems are maintained and operated to prevent pollutants from entering storm water and are formally inspected annually. Chemicals are stored in double containment areas and to prevent contact with rain water. Surplus or waste chemicals are properly recycled or disposed of at licensed offsite disposal facilities.

Urban Runoff Pollution Prevention Within 50 Feet from Top of Creek Banks

1. **Community Project Plan Review and Permitting.** The District's Ordinance 83-2 applies to all water resources in Santa Clara County and prohibits the pollution of District's water supplies, whether in surface streams, reservoirs, other conduits of any kind, or groundwater. The purpose of Ordinance 83-2 is to allow the District to properly manage streams to prevent or minimize erosion, preserve water quality, contribute to survival of the areas's fish and wildlife, and help avoid flood losses. The District requires a permit for the installation of any outfall discharging into a watercourse under District jurisdiction, revegetation, and any construction or soil disturbances within 50 feet of any creek bank. When the District reviews new projects proposed within 50 feet of a creek under Ordinance 83-2, it comments on design aspects which might affect flood protection, water supply, water utility, and stability of the creek banks, including activities which might preclude necessary stream maintenance work. The District reviews plans and issues permit only after investigating that the proposed work will not impact District's facilities. Violation of the provisions of the ordinance and any failure to satisfy the terms of the permit are punishable as a misdemeanor. The District, as a responsible agency under CEQA, comments on the same topics when it reviews environmental documents prepared for such projects and General Plan updates. However, the District does not have the authority to require design changes for those projects.

2. **Outreach to Livestock Facilities.** The focus of this outreach is to prevent non point source pollution from rangeland and mostly rural upper watershed lands that may impact District's terminal reservoirs. The District co-sponsored with the University of California Cooperative Extension, Santa Clara County Department of Agriculture, Santa Clara County Weed Management Area and Santa Clara County Open Space Authority a 5-day short course on water quality planning for open space managers. The District is also working with the University of California Cooperative Extension, Loma Prieta Resource Conservation District and Central Coast Resource Conservation and Development Council to develop outreach materials and a short-course for water quality planning and management for rural land owners.

3. **Emergency Response to Illicit Connections and Illegal Discharges.** The District provides immediate assessment and response to reports of discharge or dumping of potentially hazardous substances. District hazardous materials responders are available 24 hours a day and 7 days a week. District response procedures require response team members to contact the reporting party within 20 minutes and conduct a field investigation of the site within 2 hours of the original call. This activity has provided for the successful mitigation of releases of such materials as: waste oil, diesel, sewage, paint, and solvents. The District also provides education and enforcement to identified responsible parties.

4. **MtBE prohibition and use limitations for motorized boating at recreational reservoirs.** The District works aggressively to prevent non-point source MtBE pollution of area terminal reservoirs. The District works with County of Santa Clara County Parks Department to reduce the number of vehicles allowed on the water, eliminate refueling of personal water craft while still in the water, and restrict use to vehicles which utilize fuel obtained from 4 service stations with which the District successfully negotiated a program to supply MtBE-free gasoline.

Urban Runoff Pollution Prevention Basinwide/countywide

1. **Well Installation Guidance and spoils handling restrictions.** The District is responsible for permitting and inspecting well installations and destructions in Santa Clara County. These activities are potential contributors to surface water pollution. District inspections ensure compliance with the District Well Ordinance and State Well Construction and Destruction Standards and ensure property handling of drilling wastes. Wastes that may be generated from well drilling and destruction operations include: drill cuttings, soils, debris (wood, bricks, concrete refuse, etc.) gray water (fluids laden with typically high pH sealing materials), concrete (wet or dry), turbid water, turbine oil, fuel, hydraulic fluids, and lubricating oils. The District provides well destruction services to county residents who discover abandoned water wells on their property. The District helps the Santa Clara County Urban Runoff Pollution Prevention Program distribute pollution prevention and BMP information to area well drillers and consultants for use during well drilling activities.

2. **Targeted and General Public Watershed Education and Outreach.** The District's general outreach program targets resident throughout the county. Public outreach activities include the distribution of messages at community events such as Earth Day and the County Fair, distribution

of materials at District owned and other agency buildings, production of educational signs for District facilities, and the distribution of pollution prevention messages using the media. The District's outreach to schools includes in-school presentations, provision of curricula and other materials to teachers, coordination of contacts and other educational resources for teachers, and participation in education fairs. The District also encourages citizen participation in the Adopt-a-Creek Program and annual creek and coastal clean-up events.

3. **Santa Clara Basin Watershed Management Initiative.** The District is one of the main participants of this effort. The mission of the Watershed Management Initiative is to protect and enhance the watershed, creating a sustainable future for the community and environment. The participants will work toward the development implementation of an integrated watershed management approach to address water pollution and improve the condition of the Santa Clara Basin. The Watershed Management Initiative also serves as the public stakeholder group the Total Maximum Daily Load development. Participants in this process include: representatives from federal and state regulatory agencies, local municipalities, environmental groups, and community members.

Attachment H
Comment Letters from US Fish and Wildlife Service and National Marine Fisheries Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
1-1-01-I-2810

August 9, 2001

Mr. Calvin C. Fong
U.S. Army Corps of Engineers
San Francisco District
(Attn: Molly Martindale)
333 Market Street
San Francisco, California 94105-2197

Subject: Request for Formal Endangered Species Consultation on the Santa Clara Valley Water District Long-Term Maintenance Program Permit, Santa Clara County, California, Permit Number 22525S

Dear Mr. Fong:

This letter is in response to your May 16, 2001, request for formal consultation, pursuant to section 7(a) of the Endangered Species Act, as amended (Act), on the permit for the proposed Santa Clara Valley Water District (District) Long-Term Maintenance Program (Maintenance Program), which was received by the U.S. Fish and Wildlife Service (Service) on May 18, 2001. The District provided the draft Stream Maintenance Program document, the draft Environmental Impact Report (DEIR), and the draft Biological Assessment (BA) for the Service's review. These documents did not provide the Service with all the information necessary to initiate formal consultation on this permit as outlined in the regulations governing interagency consultations (50 CFR §402.14).

The District conducts flood protection and water delivery actions for Santa Clara County. This program has three primary activities: sediment removal, vegetation management, and bank protection. To maintain channel capacity, the District removes accumulated sediment and vegetation from streams and canals. The District conducts bank protection activities to protect private property, flood protection facilities, and other structures from erosion. The District drafted the Maintenance Program to provide procedures for design, implementation, and mitigation of these activities. The Maintenance Program area consists of 828 miles of channel in 191 natural streams and 41 miles of channel in 10 canals. The District has projected future maintenance needs based on analysis of maintenance needs from 1977 to the present. To mitigate the adverse effects to listed species and aquatic habitat, the District has proposed several actions, including tidal wetland restoration, freshwater wetland creation, and preservation of undeveloped land parcels in Santa Clara County.

To complete the initiation package, we request that the final BA contain the following information and corrections:

1. The District should articulate all the interrelated and interdependent actions, and their effects, associated with the Program. These actions may include construction and maintenance of access roads, erosion that may result from sediment removal and bank stabilization, and the additive effect of increasing hardscape in Santa Clara County streams.

2. The Service is concerned that the District's Watershed Management Initiative (WMI) is targeting stream restoration and habitat preservation efforts high in the watersheds and ignoring the potential for restoration in the lower watersheds. We commend the District's efforts to fund preservation of upland and aquatic habitats. We recommend the Maintenance Plan also include provisions to maintain and enhance habitat values in lower watersheds.

3. The Service has not received sufficient information to concur that this permit is not likely to adversely affect the San Francisco garter snake (*Thamnophis sirtalis tetratenia*) (BA, page 44). The draft BA showed four San Francisco garter snake sightings in the San Francisquito Creek watershed. In the final BA, please provide details on these sightings, including when they occurred, a characterization of the habitat where they were found, activities that may affect this habitat directly or indirectly, and any necessary avoidance and minimization measures. In addition, the Service may consider any project in the San Francisquito Creek watershed which affects the California red-legged frog (*Rana aurora draytonii*) to affect the San Francisco garter snake, as the red-legged frog is a primary prey species for the garter snake.

4. The Service does not believe that preconstruction surveys and offsite watershed preservation are sufficient to minimize adverse effects to red-legged frogs. We believe the program, particularly bank stabilization, will have significant adverse effects to red-legged frogs by altering stream hydrology and preventing the restoration of habitat. If breeding or dispersal habitat are present at a project site, we recommend the site be held to a higher standard of habitat protection and restoration, whether or not the habitat is occupied at the time of the project. Also, please provide information on how the District will avoid impacts to the red-legged frog if they are found at a project site.

5. Please describe how the amount of occupied red-legged frog habitat preserved in the Watershed Management Initiative will compare with the amount of red-legged frog habitat affected by the program. This analysis should be categorized by habitat type.

6. The District proposes to restore a 300-acre diked salt evaporation pond (Pond A4) to tidal marsh. Thirty acres of this tidal marsh will be preserved to mitigate program impacts to tidal marsh and the California clapper rail (*Rallus longirostris obsoletus*). We request that the final BA describe the general time line of tidal restoration, when habitat values will develop, how this restoration will offset temporal losses of clapper rail habitat from the program, and long-term management information such as exotic predator control. In addition, please provide the approximate acreage of tidal channel and wetland that will be impacted each year. The District also should describe whether they anticipate using 270 acres of restored marsh to compensate impacts to tidal marsh from future projects. Currently, the Service could not provide assurance that restoration completed in excess of the District's permitting requirements would serve as credit to compensate for future projects.

7. The draft BA states that clapper rail surveys will be done before sediment removal in tidal channels but provides no information on measures to protect the clapper rail from harassment and harm, specifically during the breeding season. We recommend that you include provisions in the Maintenance Program to conduct maintenance more than 500 feet away from suitable clapper rail breeding habitat unless conducted between September 1 and January 31. Also, please identify suitable clapper rail breeding habitat on a map and describe how existing clapper rail populations will be protected from sediment removal activities, particularly if they are found during preconstruction surveys.

8. The California clapper rail species account states that clapper rail breeding occurs from March through July (BA page 18). Clapper rails vocalize to attract mates in January and begin nesting as early as February. Chicks have been know to hatch as late as August. (Service files). The Service defines clapper rail breeding season as February 1 through August 31, which encompasses courtship and late breeding and nesting activities.

9. The Service does not concur that this program will not affect the federally endangered least Bell's vireo (*Vireo bellii pusillus*). The program will remove riparian vegetation from streams in the Pajaro River watershed, where the species was sighted in 1997. Please describe locations of vireo habitat in the Pajaro watershed, locations where the District will conduct maintenance in this watershed, effects of this maintenance on the ecologic and hydrologic system in the Pajaro watershed, and measures proposed to minimize these effects.

10. The Service does not concur that the Bay checkerspot butterfly (*Euphydryas editha bayensis*) will be unaffected by drift from herbicide application areas. Herbicides could kill the species' larval host plant (dwarf plantain, *Plantago erecta*) or adult nectar plants. We request that the final BA describe which herbicides effect these plants and how herbicide drift will be eliminated.

11. The Service does not concur that serpentine plants will be unaffected by drift from herbicide application areas. Herbicide application could have an adverse impact on serpentine species. We request that the final BA provide information which herbicides have the potential affect serpentine plants. In addition to analyzing the effects of herbicide drift on upland species, we request that you analyze project effects on the Mt. Hamilton thistle, (*cirsium fontinale var. campylon*) a serpentine wetland species and a Federal species of concern.

12. The Service does not concur that this program will not affect the California tiger salamander (*Ambystoma californiense*), a Federal candidate species. Tiger salamanders estivate in rodent burrows, which may be destroyed during bank stabilization and vegetation removal activities. In addition, the District proposes to use rodenticides to control ground squirrel populations. The Service considers any activity that reduces available estivation habitat for tiger salamanders to be an adverse effect. Although the tiger salamander is not a federally listed species at this time, we recommend that the District address the affects of the program on this species, in the event it is listed in the future. We request that the final BA provide data on known tiger salamander locations in Santa Clara Valley, effects of the program on the tiger salamander, measures to avoid or minimize these effects, and any other relevant information.

13. The District proposes removal of giant reed (*Arundo donax*) as a conservation measure in the program. We request that the final BA describe whether the District will take active measures to plant vegetation in giant reed removal areas, the type of vegetation or bank stabilization that will replace this species, and whether these areas will be preserved from future long-term impacts.

14. Please provide the locations of all unmodified channels encompassed by the maintenance program. We recommend that work in these channels be held to a higher standard of environmental protection than modified stream reaches. We suggest that measures such as limiting or prohibiting herbicides, minimal vegetation removal, prohibiting hardscape for bank stabilization, or restoration of natural channel stability be incorporated into the program in these reaches.

15. Although it is not mentioned as part of the stream maintenance program, the District owns and maintains numerous roads that provide access from levees to channels. Access road maintenance may accompany sediment removal or bank stabilization work, when changes in flow have eroded portions of these roads. Please describe the extent of road maintenance, the effects to aquatic and listed species habitat from the presence of these roads, and, if possible, future measures to reduce the number of access roads.

16. In the cumulative effects section of the final BA, please describe how future Capital Improvement Projects will affect upland and aquatic areas, including approximate acreage, and how future urban growth in Santa Clara County will affect upland, riparian

and aquatic ecosystems, and listed species habitat. In addition, please provide information on how the District's water storage and delivery programs affect listed species.

17. The Stream Maintenance Program does not contain any provisions for reporting to regulatory agencies on what activities were conducted, what BMPs were implemented, and how the projects avoided or minimized effects to listed species or their habitat. We request that annual reports be included as part of the program and that this information be provided in the final BA.

18. We are concerned with the adverse impacts of the bank protection program to listed species. This program will increase hardscape on County streambanks each year by an average of 0.5 mile. This work appears to be incompatible with the WMI. We suggest that the District's proposal for hardscape bank stabilization accompany a gradual plan for phasing out the use of hardscape, and replacing existing hardscape with restored riparian corridors to the extent feasible.

19. The District installs in-stream flow barriers to increase groundwater percolation. Please describe maintenance work in and near these structures that would be included in the Maintenance Program, and please analyze potential impacts to the red-legged frog from these structures.

20. The Service objects to the District's proposal to give itself mitigation credit for bank stabilization projects that use native riparian vegetation in their design (BA, page 60). Erosion and deposition are natural processes of a dynamic stream system. The control of these processes is an impact to the ecosystem, and the use of native vegetation is a measure to minimize this impact. In addition, vegetated sites typically require several years of growth before they provide habitat and should not provide credit for hardscape projects in other locations.

21. We recommend that the final BA describe the monitoring and management that will occur at created wetlands. In addition, the use of artificial water sources to sustain for some of the proposed mitigation wetlands is inconsistent with an ecosystem approach to resource management. We recommend that alternate wetland creation sites be identified which would be sustained by natural hydrology.

22. BMPs 1.13 and 1.15 recommend structural solutions to scour in areas below sediment removal and riprap sites. This practice perpetuates the need for hardscape at the expense of natural features. We suggest the final BA contain modified BMPs that address the root causes of bank destabilization ans uses natural methods to prevent and minimize erosion.

23. BMP 3.1 states, "The District shall identify serpentine areas and avoid disturbance to these areas to the extent possible." Please list circumstances where disturbance would not

be avoided, and measures to be implemented to minimize and compensate for the impact of this disturbance.

24. Land management practices such as overgrazing or inadequate erosion control during construction can load sediment to streams and wetlands, placing a burden on the District to remove the sediment. We recommend that the final BA show specifically how the District is working to reduce nonpoint source pollution from uplands.

25. On page 2 of the BA and elsewhere, the status of the Tiburon paintbrush (*Castilleja affinis* ssp. *neglecta*) should be changed to federally endangered, not threatened.

When we receive all of the information, the Service will resume the formal consultation process for the permit. If you have any questions or concerns about this consultation, please contact Cecilia Brown or Dan Buford at (916) 414-6625.

Sincerely,

Jan C. Knight
Chief, Endangered Species Division

cc:
Maura Eagan, National Marine Fisheries Service, Santa Rosa, CA
Cindy Roessler, Santa Clara Valley Water District, San Jose, CA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95407

JUL - 2 2001

In reply please refer to:
151422-SWR-00-SR-408: ME

Calvin C. Fong, Chief, Regulatory Branch
U.S. Department of the Army
San Francisco District, Corps of Engineers
333 Market Street
San Francisco, California 94105-2197

Dear Mr. Fong:

Thank you for your May 16, 2001 letter requesting initiation of formal section 7 consultation with the National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). The consultation concerns the possible effects of the proposed U.S. Army Corps of Engineers (Corps) permit for the Santa Clara Valley Water District Stream Maintenance Program (SMP) in Santa Clara County, California (file #2252S). The Corps is proposing to permit the SMP for ten years, under section 404 of the Clean Water Act. Per your request, NMFS is examining the projects effects on threatened Central California Coast and South-Central California Coast steelhead and on designated critical habitat for the species. In the same letter you also requested consultation for Essential Fish Habitat (EFH) for various life stages of chinook salmon managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

Although NMFS has participated in the development of the SMP, and recognizes the investment of time and energy that have gone into this proposal, we cannot concur that all of the activities proposed will avoid adverse effects to listed salmonids. In particular, vegetation management, fish relocation, and new bank stabilization proposed in the SMP are likely to adversely affect listed steelhead and/or critical habitat. As a result, formal consultation is warranted.

Our preliminary review of the proposed maintenance activities to be conducted under this 10-year permit indicates most of the potential impacts to threatened steelhead and critical habitat can be addressed through specific guidelines and criteria in a programmatic biological opinion. However, bank stabilization is problematic, because the Water District has included new and "proactive" projects in the SMP, in addition to repairs. Since the specific locations, size, and type of treatments (i.e. rip-rap, gabions, willow mattresses) for new bank stabilization projects by the Water District can not be identified at this time, NMFS can not determine the extent of possible impacts to threatened steelhead and designated critical habitat associated with these activities. Additionally, new, or "proactive" bank protection is not a "routine maintenance activity", and NMFS has recommended these activities not be included in the SMP. However, if the Corps and Water District choose to include new bank stabilization in this 10-year permit, NMFS will review each proposed action as project-specific details become available and provide incidental take authorization, as needed, for each project through a letter tiered from the programmatic biological opinion.

Although we have received your request and project documents (including a JARPA application package dated February 15, 2001, the Draft Environmental Impact Report dated March 28, 2001, the Draft Stream Maintenance Program dated March 2001, and the Draft Biological Assessment dated April 2001), NMFS has not yet received all of the information necessary to initiate formal consultation as outlined in the regulations governing interagency consultations (50 CFR §402.12 - §402.14). My staff has communicated with the Corps of Engineers' project manager, Molly Martindale, and with Water District staff regarding our additional information needs through telephone and email communications during late 2000 and early 2001. The additional information required by NMFS to proceed with consultation is presented in the Attachment to this letter.

Please provide the above information to Maura Eagan at National Marine Fisheries Service, Santa Rosa Area Office, 777 Sonoma Avenue, Room #325, Santa Rosa, California 95404. If you have questions concerning this request for additional information, please contact Maura Eagan at (707) 575-6092.

Sincerely,

Patrick J. Rutten

Patrick Rutten
Protected Resources Manager
Northern California

Enclosure

cc: Molly Martindale, Corps
Cindy Roessler, SCVWD
Margaret Roper, CDFG
Cecilia Brown, USFWS
J. Lecky, NMFS

Enclosure
Additional Information Needs for NMFS Section 7 and EFH Consultations

Page numbers refer to the Draft Biological Assessment. Please provide the following information:

1. An assessment of the SMPs effects on EFH species (chinook salmon) in the Guadalupe River and Coyote Creek. The Species Account for chinook salmon (p 29) should include its designation as an EFH managed species.

2. An assessment of the effects of the SMP activities on designated critical habitat elements (including, but not limited to, safe passage conditions, spawning sites, water quality and quantity, and riparian vegetation) for the Central California Coast and South-Central California Coast Evolutionarily Significant Units (ESU) of steelhead. Please include the effects of beneficial activities developed by the Corps and their applicant as directed by section 7a1 of the ESA.

3. Further analysis of the of the indirect and cumulative effects of the actions conducted over the duration of this 10-year permit. The Draft Biological Assessment identifies, but does not elaborate on, significant potential cumulative effects of the SMP (p13). Please include an assessment of the specific cumulative impacts of the SMP activities, such as the cumulative impacts of repeatedly removing sediment and vegetation at one given site.

4. Please address the question of how cumulative impacts will be compensated for through one-time mitigation. Mitigation is proposed for impacts to stream vegetation from sediment removal and vegetation management activities, but bank stabilization activities are not included in the Draft Biological Assessment (p 14). How will unavoidable impacts to the stream banks, loss of habitat and riparian functions be mitigated for these projects? In general, mitigation for riparian habitat losses seems inadequate. Unavoidable impacts, habitat degradation and habitat loss should generally be mitigated at a 3:1 ratio. Mitigation plans are not specific. Will mitigation activities begin or be completed before maintenance activities that cause negative effects? Please clearly define the goals, objectives, and success criteria of the stream and watershed protection mitigation (p 15). What does "preserve, protect, and improve" mean for steelhead habitat conditions?

5. Please present brief descriptions of currently existing riparian habitat and physical conditions at each of the sites projected for activities that are repetitive in nature.

6. Please specify watersheds and stream reaches that support "high quality habitat" for steelhead, and include the criteria that determines the various qualitative habitat designations. How much of the SMP project area is designated as high , medium and low quality habitat? Please revise the fisheries map (figure 13 in the Draft Biological

Assessment) to show that downstream segments downstream of high quality habitat have fishery value, if only as migratory corridors.

7. Please discuss sediment inputs to the watersheds where sediment removal activities are above tidal zones. Will the District address the problem of ongoing land uses that contribute to sediment loading in the upper watersheds, in order to minimize impacts to the streams from sediment removal activities?

8. Specific work windows for "dry season" work below ordinary high water should be limited to June 15 to October 15. In general, work outside this window should not be included in the SMP, although exceptions could be proposed and considered for waterways with no fishery value, such as the Sunnyvale East channel.

9. A list of specific pesticides that will be used in areas where aquatic habitats may be affected either directly or indirectly. Please include product name and label information, and Material Safety Data Sheet information sheets for each pesticide. In order to comply with The U.S. Environmental Protection Agency's Interim Measures for use of Pesticides in Santa Clara County, pesticides with an aquatic species hazards class (e.g. Pendulum) should not be applied in currently occupied habitat, or within 200 yards (for air applications) or 40 yards (for ground applications) of habitat. Pesticides with similar actions but lower risks (e.g. Pebulate) should be substituted, and pesticides approved for use in aquatic habitats are preferred.

10. Bank protection that replaces failed protection with in-kind techniques or improved biotechnical methods may be addressed in the programmatic biological opinion with guidelines and criteria. However, the specific locations, size, and type of treatments (i.e. rip-rap, gabions, willow mattresses) for new bank stabilization projects by the Water District must be provided to NMFS for determination of the extent of possible impacts to threatened steelhead and designated critical habitat associated with each project. ESA authorization for each new bank stabilization project may be provided by NMFS through a letter tiered from the programmatic biological opinion. Please define "small repair sites" (p 12), and expand the discussion of techniques that are considered to "retain the highest biotic potential" (p 12).

11. Minor maintenance activities, notably the replacement of culverts and fish passage facilities should meet NMFS criteria for fish passage. These criteria are available on the web at <http://swr.nmfs.noaa.gov/habitat.htm>. Repair activities should also address improvements to the existing conditions for the benefit of steelhead and chinook.

12. Please describe how the SMP will be modified over time to incorporate new information regarding distributions or habitat values for steelhead and chinook salmon. For example, the Draft Biological Assessment states that steelhead in the Coyote Creek watershed are confined to Upper Penitencia Creek. Recent data collected in the Fisheries and Aquatic Habitat Collaborative Effort has documented the presence of steelhead and good quality spawning and rearing habitat above the Metcalf Ponds on the mainstem of Coyote Creek.

Changing conditions may affect which Best Management Practices (BMPs) apply, and may require additional authorization from NMFS.

13. Several of the proposed BMPs would better protect the needs of listed steelhead and EFH if they were modified. These include the following;

1.3 Diversions shall maintain habitat connectivity and result in no change in flow quality, or quantity from ambient conditions.

1.4 Temporary diversion structures shall be removed immediately following completion of in-water construction, unless they will provide improved habitat conditions. For example, gravel berms could potentially provide enhanced spawning area and disturbance associated with removal would be avoided.

1.5 Erosion control methods should be implemented before, during and after construction.

1.14 Herbicides used within 200 yards (for air applications) or 40 yards (for ground applications) of streams should be approved for aquatic use.

2.5 Please expand on "District revegetation guidelines". What plant species are included? Where, when, and at what densities will revegetation be done? What are the success criteria?

2.7 When is seeding of a site typically done?

3.1 Please define where special status species are by watershed, sub unit, or stream reach. Because they must often pass poor quality habitat to reach spawning and rearing area, please consider habitat connectivity along the length of each watershed for steelhead and chinook salmon.

3.1.7 Please include NMFS in reports generated whenever survey results include steelhead and/or chinook. This information could be included in the end of year reports on the SMP.

3.7 Relocation of steelhead from project reaches deserves more discussion. What methods are proposed? In general, NMFS may approve relocation using one or more of the following methods : dip net, seine, throw net, minnow trap, hand. Electrofishing may be used by qualified, experienced biologists. If electrofishing is proposed, please provide names and qualifications of the biologists proposed to performed this work. If possible, please provide an estimate of tha amount or extent of relocation activities in a typical season. This could be an estimated number of individual fish, or an area or lineal extent of habitat affected by the activity.

3.9 Numbers 2 and 4 (p 41) appear to be in complete conflict. Please clarify under what circumstances any woody debris that contribute to habitat complexity will be retained.

3.10 Specific dates for work windows should be limited to June 15 through October 15. Specific watersheds should be identified where this BMP will apply, and this list should include, at a minimum, the watersheds of the Guadalupe River, Coyote Creek, Stevens Creek and San Francisquito Creek.

14. Further analysis of the effects of vegetation management. Vegetation management activities are likely to adversely affect listed steelhead and their critical habitat. Removal of vegetation degrades riparian functions, by decreasing cover and increasing water temperatures. Herbicide use may directly kill salmonids, and have other indirect effects, such as lowering dissolved oxygen levels as vegetation decays.

15. Further analysis of the effects of bank stabilization. Bank stabilization activities are likely to adversely affect listed steelhead and their critical habitat. While NMFS realizes that some bank protection projects and methods provide benefits which include reduced sediment inputs, the majority of projects reduce riparian and instream habitat complexity and adversely modify localized hydraulics. Biotechnical methods, in particular, may reduce these adverse effects, and projects that improve fishery habitat values may be "self mitigating". The Water District's commitment to these environmentally sound methods is to be commended.

Please discuss the temporal loss of fishery values in the section regarding effects of bank stabilization. Please expand on the matrix developed in the Draft Biological Assessment with clear criteria for each habitat quality designation, determination of instream functions, and methods that retain, enhance, or limit biotic potential. Because many of the 191 streams addressed in the SMP "support or have the potential to support" steelhead, or are downstream of those reaches that support steelhead, the matrix needs to be refined. Although NMFS realizes that resources may be limiting, bank protection methods should enhance existing habitat conditions wherever possible. Projects that enhance habitat values may be mitigated at a lower level, or in some cases be self mitigating. Methods that degrade existing habitat conditions, or merely maintain poor habitat conditions should generally be mitigated at a 3:1 ratio. Please clearly delineate criteria by which a project that enhances habitat values may be self-mitigating. Please discuss mitigation for the "neutral or impact" effects of bank stabilization.

Responses to the August 9, 2001 USFWS and July 2, 2001 NMFS letters can be found in the Biological Assessment at the page numbers indicated below. References to BMPs can be found in the BMP table in Attachment A.

#	Topic	Page Number(s) in BA
USFWS August 9, 2001 Letter		
1	Interrelated and Interdependent Actions	pp. 58-59
2	Stream and Watershed Preservation - should occur in lower watershed in addition to upper watersheds	p. 58
3	San Francisco Garter Snake - additional information	pp. 29-30, 41 Table 6 Figure 10
4	Red-Legged Frog - preconstruction surveys and offsite watershed preservation not sufficient minimization; bank protection will affect by altering stream hydrology and preventing restoration; provide information on how effects avoided when red-legged frog found on site.	pp. 41-43, 57-58
5	Red-Legged Frog - compare amount and habitat type of area affected to proposed preservation land.	pp. 57-58 Attachment E
6	Tidal Marsh Restoration - timeline and management; acres of tidal channel affected.	pp. 21, 56-57 Tables 7 and 12
7	Clapper Rail - measures to protect	p. 40 Figure 8
8	Clapper Rail - breeding period	pp. 28, 40
9	Least Bell's Vireo - describe locations, effects, and measures to minimize effects.	pp. 40-41 Table 8
10	Bay Checkerspot Butterfly - effect of herbicide drift	p. 53 BMPs 3.1, 3.3
11	Serpentine Plants - effect of herbicides	p. 53-54 BMPs 3.1, 3.3

12	Tiger Salamander - additional information on locations and effects.	pp. 31, 43-44 Table 10 Figure 11
13	Giant Reed Removal	p. 21
14	Unmodified Channels	Attachment B
15	Maintenance Roads	pp. 17, 58
16	Cumulative Effects - capital improvement projects and future urban growth	pp. 60-61 Table 13
17	Reporting	p. 22
18	Bank Protection - hardscape	pp. 43, 46-48 Attachment C
19	Instream flow barriers	p. 27
20	Bank Protection - mitigation	pp. 46-48 Attachment C
21	Monitoring and Management of Mitigation	p. 21-22
22	Structural Solutions to Erosion - also root cause of erosion	pp. 16, 58-59
23	Serpentine Areas - describe minimization	pp. 53-54
24	Control of Non-point Source Pollution	Attachment G
25	Tiburon paintbrush - status is endangered.	pp. 2, 36
	NMFS July 2, 2001 Letter	
1	Essential Fish Habitat Analysis	pp. 1, 34-35, 49-50
2	Critical Habitat Elements	pp. 44-49
3	Cumulative Effects	pp. 59-61
4	Mitigation • One-Time Accounting • Mitigation for Bank Protection • Stream and Watershed Protection	 • pp. 59-60 • pp. 20, 48, Attachment C • pp. 21, 57-58

5	Describe riparian habitat and physical conditions at each of the sites.	p. 7
6	Steelhead Habitat Descriptions	pp. 24, 47-48 Attachment C Figure 4
7	Sediment Inputs & Land Use	p. 8
8	Dry Work Season	BMP 3.10
9	Herbicide Limitations	pp. 12-14 Table 1 BMP 3.20
10	Bank Protection - describe types	Attachment C
11	Culvert Repair	A reference to stream crossing guidelines has been added to the description of minor work activities on p. 17.
12	Incorporation of New Information	BMP 3.19
13	Habitat Connectivity	BMP 1.3
	Temporary Diversion Structures	BMP 1.4
	Timing of Erosion Control	BMP 1.5
	Herbicide Limitations	This issue not relevant to BMP 1.14, however, herbicide limitations are discussed on pp. 12-14, Table 1, and BMP 3.20
	District Revegetation Guidelines	Re comment in BMP 2.5, see Attachment C.

13 cont.	Seeding	Re BMP 2.7, seeding is typically conducted when maintenance work leaves a bare bank such as during grading associated with installation of a bank protection project, installation and subsequent removal of a temporary access ramp, or when a facility does not have a maintenance road and equipment needs to operate at the top of a bank during sediment removal.
	Location of Special Status Species	Re BMP 3.1, see Figure 4 regarding location of different fisheries categories.
	Reporting	BMP 3.1
	Relocation of Steelhead	BMP 3.7 Attachment F
	Retaining Woody Material	Re BMP 3.9, we do not consider these conditions to be in complete conflict. Woody debris (dead) and woody vegetation (live) will be retained as fish habitat unless they could cause flood management problems such as impede flood flows or cause erosion.
	Dry Work Season	BMP 3.10
14	Vegetation Management Effects on Salmonids	p. 45-46
15	Bank Protection Effects on Salmonids	pp. 46-48 Attachment C